

GLASS-MAKING.

1. DRAWING THERMOMETER TUBES.

3. GLASS-BLOWING.

2. IN THE GLASS-WORKS.

CASSELL'S
ENCYCLOPÆDIA
OF GENERAL INFORMATION

NAWAB SALAR JUNG BAHDUR.

WITH COLOURED PLATES AND MAPS
AND NUMEROUS FULL-PAGE ENGRAVINGS

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NAWAJAH SALAR JUNG BAHADUR.

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CASSELL'S ENCYCLOPÆDIA.

Friction, in *Dynamics*, is a resistance offered to the relative motion of one body over the surface of another, due to roughness of the parts in contact. It is very difficult to rub two files together, the teeth of one file fitting more or less into the hollows of the other, and the obvious reactions of the teeth preventing relative motion. In that case motion either takes place by reason of the up-and-down slide of one set of teeth over the other, or by breakage of the teeth and a consequent complete change of the surfaces in contact. Such is the nature of friction; and its effects are not to be confounded with those of electrical actions that may take place when two substances are closely opposed, and that may help to resist lateral motion. It follows from the above that (i) friction always opposes the lateral motion; (ii) that it increases if the pressure between the two surfaces be increased; (iii) that the force required to start the motion after the surfaces have settled into intimate contact is greater than that required to keep up the motion; (iv) that there is a waste of energy in producing the motion, which will probably exhibit itself as heat; (v) that the friction may be diminished if by means of oil or some solid unguent the two rubbing surfaces may be separated a little and made to roll past each other on a thin film of the given lubricator. It is usual to distinguish between two kinds of solid friction—(a) *sliding* or *kinetic* friction, where sufficient force is applied to overcome the resistance offered to the motion. In this case the whole force of friction is experienced. It is found to be proportional to the total pressure, and to be practically independent of the extent of the surfaces in contact. Thus a load of one ton, distributed over a few square inches, introduces the same total friction as when it is distributed over a square foot, providing that the nature of the substances in contact is the same in both cases. Sliding friction is further found to be independent of the speed of motion. The force of friction per unit load is called the *coefficient of friction*, and is denoted by the letter μ . If W is the total load, the whole force of friction is μW . The coefficient is, therefore, the ratio of the force of friction to the total load. For steel on ice it has the value .014; for deal on deal, .35; steel on steel, .146; granite on granite, .30; and woollen cloth on cloth, .43. These results are due to George Rennie. (b) *Static* friction, where the external forces which act are

insufficient to overcome the whole available force of friction, and only balance part thereof. There is thus no production of motion against resistance and no evolution of heat. A cylinder would slide down a frictionless inclined plane without rolling; but with a sufficient intensity of friction each particle of the cylinder in contact with the plane would there be rendered motionless, and the upper parts would move downwards. This would cause rolling, and the energy spent in producing the rotation about the axis of the cylinder diminishes the amount left to increase the kinetic energy of the cylinder as a whole, which, therefore, rolls more slowly down the rough plane than it would slide down the smooth plane. Though rotatory motion is here actually caused by friction, it will be seen that it is yet a case of static friction; the total friction between cylinder and plane is not all employed in bringing the various particles successively to rest. Whether the friction be great or small, if it is sufficient to prevent any sliding, the cylinder will roll down with the same speed. This action of static friction in preventing sliding is of much utility; ordinary walking could be impossible without it, and there are many cases where it is put to some practical use. Thus, the action of friction-brakes depends partly on static friction, partly on kinetic. Power is transmitted from one pulley to another by belting that connects them; the power could not be transmitted unless there were static friction between pulley and belt. [LUBRICATION.] The friction of liquids is very slightly understood; the previous illustration of solid friction by means of two files cannot be of much help in understanding fluid friction, on account of the complex action of viscosity (q.v.) in setting the fluid in motion. It differs in two important respects from solid friction; its magnitude is independent of pressure, instead of increasing proportionately to the latter; and also its magnitude, instead of remaining constant when the speed varies, increases more than proportionately. For slow speeds, such as that of a slow river, fluid friction is proportional to the speed. For higher speeds, such as are attained by fast vessels in water, it varies as the square of the speed; and for such rates as are attained by projectiles in air, it varies as the cube of the speed. These laws must only be regarded as approximate.

Friday, the name of the sixth day of the week, is derived from the Anglo-Saxon *Frigga-dæg*—that is, the day sacred to Frigga, wife of Odin. The German is *Freitag*, and the Swedish *Fredag*. As the day on which Christ was crucified, it is observed by Romanists and strict Anglicans as a fast-day. This day is still looked upon by sailors of all nations as an unlucky one on which to commence a voyage.

Friedland, the name of several towns in Germany, the most famous being in East Prussia, 27 miles S.E. of Königsberg, on the left bank of the Alte. Here in June 14, 1807, Napoleon I. defeated the Russians and Prussians, and forced them to conclude the Peace of Tilsit.

Friedland, VALENTIN, also surnamed TROTZENDORFF, from his birthplace in Upper Lusatia, attained high repute as a teacher. In 1518, at the age of 28, he visited Wittenberg, where he came under the influence of Luther and Melancthon, with whom he contracted a warm friendship. A few years later he was appointed rector of the Gymnasium at Goldberg in Silesia, and achieved great success. He died in 1556.

Friendly or Tonga Islands, amounting to 180 in number, of which about 30 are inhabited, are situated in the South Pacific (lat. 18° to 24° S., long. 178° to 176° W.). They were discovered by Tasman in 1643, visited by various explorers in the next century and a half, but named collectively by Cook. The natives are the most advanced of the Polynesian race. Formerly a dual sovereignty like that of Japan existed, but King George Tubou II. is now the sole monarch, and has established a constitutional government. By the Samoa agreement of 1889 Germany renounced her rights over these islands in favour of Great Britain. The British Commissioner of the Tonga Islands proclaimed a protectorate at Tonga in 1900. Physically, the group consists of submerged volcanic rocks, topped by coral formations of limestone, and covered with a deep rich mould that is highly productive. Peaks rise here and there to a height of 4,000 or 5,000 feet, and there are three active volcanoes, but the surface is generally level. Water is scarce and bad, and streams are rare. The vegetation is luxuriant, cocoa-nuts, sugar, cotton, coffee, copra, fruits, and vegetables being grown for exportation, and some varieties of timber, such as iron-wood, possess marketable value. Sheep and cattle do not thrive. Fishing supports a large number of the population. Tonga-tafo, the largest of the group, has an area of 128 square miles, and contains the capital, Nukualofa; Vavau, Eua, Nomuka, Lefuka, Tofua, Late, and Kao come next in size. The climate though elevating and damp, with considerable changes of temperature, is fairly wholesome; but leprosy, elephantiasis, and scrofula play havoc with the natives.

Friendly Societies, a form of mutual provident association which grew up in the latter part of the 17th century. They were recognised by the legislature in 1793, and by the Act of 1829 central was substituted for local registration—separate registrars being appointed for England, Scotland, and

Ireland. During the reign of Queen Victoria they were organised on a sound financial basis, and the "Ratcliffe Tables," the final outcome of much study, were accepted by the Royal Commission of 1871-74. By the legislation of 1875-76 one chief registrar was appointed, and it was enacted that audits should be held annually and a valuation of assets and liabilities at intervals of five years. Affiliation became legal in 1850, and since 1874 no obstacle has been placed in the way of the registration of branches. The *affiliated societies*, of which the Oddfellows and the Foresters are the most important, now include many members in the Colonies as well as Great Britain. Each *lodge*, *court*, *senate*, or *tent* has its own sick-fund, and enjoys almost unlimited freedom in the management of its own affairs. They are, however, grouped together in *districts* under the general control of a *central body* composed of elected delegates. The *collecting societies*, so called because they collect subscriptions by calling every week or fortnight at each house, occupy the first place numerically, containing over three million members, chiefly belonging to the poorest class. Their benefits are confined to insurance at death, and expenses of management absorb a large part of the funds. There are several other kinds of friendly societies, including the old *local societies*, which are gradually diminishing in number with the advance of those of a superior type. To this class belong the clubs which periodically divide their funds among the members.

Friends, SOCIETY OF, a Christian sect popularly known as QUAKERS. The latter name arose from the circumstance of their founder, George Fox (q.v.), having bidden a Derby magistrate to tremble at the Word of God. At first applied in derision, the word gradually came to be used by the Quakers themselves. Their proper designation originated in the practice of addressing each other as "friend" rather than by name. They hold as a body the leading doctrines of orthodox Christianity, but differ from the Church and the sects on important secondary points, and especially in the matter of practice. Their central doctrine is that of the inner light, which they derive from St. John's Gospel: "the light that lighteth every man that cometh into the world." This leads them to reject training in theology or secular learning as a preparation for the ministry, as well as the outward observance of sacraments and holy days, and set forms of prayer. At their meetings any member, man or woman, is listened to when he or she is moved to speak by the Holy Spirit. Their differences with other Christians on the subject of oaths and the payment of tithes led to much persecution in their earlier days, though they themselves sometimes provoked it by entering churches and interrupting services. They cite the words of Scripture (Matt. v. 34) as to oaths, and also as to the unlawfulness of war (Matt. v. 39, 44, etc.). During the Commonwealth and the Restoration period Quakers were punished by mutilation and banishment; 5,000 were imprisoned under Charles II. The Toleration Act (1689) allowed them to hold meetings after signing a confession of Christian belief,

a declaration against transubstantiation, and a promise of fidelity to Government. Their objections to the payment of tithes and to oaths have been met by the conversion of the former into rent-charge and by an Affirmation Act. Their own ministers are not paid, but receive hospitality. In the nineteenth century there was a serious schism among the Quakers. It is called the Hicksite movement, from Elias Hicks, who in 1827 denied the divinity of Christ and the orthodox view of inspiration. About half the sect in America followed him. This was followed by a movement in England under Joseph John Gurney, who advocated doctrinal education and the relaxation of some Quaker practices. The orthodox in America took alarm at this, and John Wilbur formed a sect in which the strictest traditions of the Society were adhered to. Wealth has to some extent undermined their strictness, if not their simplicity. Monthly meetings of the Society are held for educational and charitable purposes, and to deliberate upon the admission and correction of members, and the appointment of ministers. Preparative meetings get ready the business for the monthly, and the business of the latter is revised and controlled by meetings held quarterly. These last report to yearly meetings, which exercise a general supervision over the affairs of the Society. The Friends number at the present time about 120,000, of whom 90,000 are in the United States. Among their leading names have been Robert Barclay, author of a *Catechism and Confession of Faith* (1673); William Penn, founder of Pennsylvania; Elizabeth Fry, the prison philanthropist; and John Bright. Fox's *Journal* gives an account of the early days of the Quakers; Sewel's *History* of them was published in 1722; and Mr. Storrs Turner's work (1890) surveys and criticises their history and opinions from their origin to that period.

Fries., ELIAS MAGNUS, born at Småland, Sweden, in 1794, was early led to the pursuit of botany by his father, an intelligent pastor. At the age of 12 he discovered a new fungus, *Hydnum*, and henceforward he devoted himself chiefly to studying the cryptogamia, upon which he wrote many learned treatises, not, however, neglecting other varieties of the Scandinavian flora. After graduating at the university of Lund, he became professor in 1824, and ten years later was transferred to Upsala, which he represented in the Rigsdag. He was elected a foreign member of the London Royal Society in 1875, and died in 1878.

Fries., JACOB FRIEDRICH, was born at Barby, Saxony, in 1773, and brought up by the Moravians. He studied philosophy at Leipzig and Jena, and began to lecture on the subject in 1801, adopting the theory of Kant, with certain modifications of his own. Whilst accepting the division of knowledge into an *a priori* and an *a posteriori* element, as propounded in the *Kritik*, he treated the former as consisting of the mere irreducible factors that defy our processes of psychical analysis. Moreover, he regarded the understanding as in itself a mere instrument of proof devoid of all antecedent

principles of knowledge. These views he elaborated in a series of works, of which his *New Critic of Pure Reason*, his *System of Logic*, and his *System of Metaphysic* are the best known. In 1806 he received a chair at Heidelberg, returning to Jena in 1816, and continuing his teaching until his death in 1843, though he was for a period placed under an interdict, owing to his supposed democratic leanings.

Friesland or VRIESLAND, the most northerly province of Holland, lies upon the shore of the Zuider Zee and North Sea, and is bounded inland by the provinces of Drenthe, Groningen, and Over-Yssel. It has an area of 1,281 square miles, being, for the most part, flat and below the level of the sea, which is kept out by huge dykes. The soil consists largely of sandy heaths, diversified by lakes, peat-bogs, and a few forests. The pastures in the N. and W. support herds of cattle, the principal source of prosperity, except fishing and flax-growing. The province, which includes the islands of Ameland, Terschelling, and Schiermonnikoog, is composed of three divisions—Leeuwarden, Heerenveen, and Sneek. Besides the capital, Leeuwarden, the chief towns are Harlingen, Sneek, Bolsward, and Dokkum. [FRISIANS.]

Frieze (French *frise*; Ital. *fregio*, ornament) is, in classical architecture, the part of the entablature between the cornice and the architrave; but the term is sometimes used of any ornamented horizontal band.

Frigate, a vessel of war carrying all her guns on her main-deck, quarter-deck, and forecastle, commanded by a post-captain, and rigged as a ship. She mounted from 20 to 50 guns. The modern equivalent of frigates, which were the eyes and scouts of a fleet, are cruisers. The first frigate, properly so-called, in the English navy was the *Southampton*, 32, built in 1757; but vessels loosely named frigates were common from the time of the Dutch wars. The term then signified merely a light, fast type of cruiser.

Frigate Bird (*Fregata*), a genus of tropical and sub-tropical web-footed birds. The strong, hooked bill is longer than the head; wings long and pointed; tail of twelve feathers deeply forked. *F. aquila* is generally distributed in tropical regions; length about 40 inches, dusky above, white below. The under surface is darker in adult males and they have a distensible, orange-coloured gular sac. *F. minor* is confined to the Eastern seas, and is very numerous in Torres Straits. Both species are very strong on the wing.

Frilled Lizard. [*CHLAMYDOSAURUS*.]

Fringes, in the various phenomena of diffraction, mean edgings of colour between light and shade, that may be produced by small screens in the path of light or by small beams of light admitted through orifices in larger screens. The corpuscular theory of light advocated the rectilinear propagation of light corpuscles, and so explained the definite line of demarcation between light and

shadow, when any opaque obstacle was placed in the path of a beam of light. It denied the possibility of light travelling round corners in a homogeneous medium, and its supporters showed the apparent invalidity of the wave theory by pointing out that waves, such as those of sound in air or water, will travel round corners. The wave-theorists showed by these fringes that light did travel round corners, though not to the same extent as sound-waves by reason of the great difference in the wave-lengths in the two cases. A simple case of formation of diffraction-fringes may be seen when the eyes are directed towards the sun, and so nearly closed that the eyelashes come down in front, and form a sort of grating of fine threads. These act as screens from the light, but, instead of seeing so many black lines of shadow, a series of bands of colour are seen. The colour exists in those parts in the shadow of the lashes, and is thus separated because of the different powers of the different colour constituents of the sunlight to be deflected round the corners presented by the grating.

Fringillidae. [FINCH.]

Frisians, an historical Low German people, whose descendants still occupy much of the Dutch provinces of Friesland and Groningen, the neighbouring Prussian district of East Friesland with all the adjacent islands, and the North Frisian Archipelago on the west coast of Schleswig-Holstein. Their domain formerly comprised most of the coastlands along the shores of the German Ocean between Denmark and South Holland, and extended southwards to the Rhine estuary. Many Frisian tribes took part in the Germanic invasion of Britain in the 5th century, and the Frisian element undoubtedly enters largely into the constitution of the present populations of Great Britain. Kent, the Isle of Wight, Hampshire, and some other districts farther north are supposed to have been mainly repeopled by Frisian immigrants, and the Frisian language still shows marked affinities to the provincial dialects as far north as Northumbria. During the long struggle (6th to 9th century) between the Franks and Saxons the Frisians formed part of the Saxon League, but after the defeat of their last king, Radbod II., who took refuge in Denmark, they were incorporated in the empire of Charlemagne (775). On the reduction of the Saxons and the conversion of their king, Witikind, to Christianity (805), the Saxon and Frisian territories were divided into administrative districts (*gau* or *pagi*) under the Frankish Empire. But all the Frisian states, whose delegates met annually near Aurich in the present province of Hanover, continued to enjoy practical "Home Rule" till 1522, when they were forced to recognise the authority of the German Emperor, represented by Charles of Austria, Count of Holland and Zealand. Since 1579, when the West Frisians joined the Union of Utrecht, the western section of the nation has followed the destinies of Holland, and here its racial purity, language, usages, and traditions have been best preserved. The Frisians are distinguished from their Dutch neighbours by their taller stature,

slimmer and more shapely figures, more oval features, much lighter and more florid complexion with light blue or grey eyes and flaxen or brown hair. Most of them are now bilingual, speaking both Dutch and a very pure dialect of the Old Frisian, which differed in several marked respects from Anglo-Saxon, Continental Saxon, and other neighbouring members of the Low German linguistic group. It is still the mother tongue of about 800,000 persons, of whom 600,000 are West Frieslanders (Holland) and 200,000 East Frieslanders (Germany and the islands). (Rask, *Frisisk Spræglære*, 1825; Wiarde, *Geschichte der Ostfriesländische*, 1817; Lubach, *Les Habitants de la Néerlande*, in *Bull. de la Soc. d'Anthropologie*, iv., 1863.)

Frith, JOHN, one of the forerunners of the Reformation in England, was the son of an inn-keeper at Westerham, Kent, and must have been born early in the 16th century. Educated at Eton and King's College, Cambridge, he was invited by Wolsey to transfer himself to Cardinal's College, Oxford. His avowed sympathy with the German heretics led to his imprisonment. Wolsey got him released, and he went to Marburg where he remained until 1532, writing several controversial works. On his return he was seized by Sir Thomas More, and thrown into the Tower. He might have escaped with his life, but the treacherous disclosure of a "lytle treatise" on the Sacraments roused the king's attention, and Frith was burned at Smithfield in 1533.

Frith, WILLIAM POWELL, R.A., born at Studley, near Ripon, in 1819, began to study painting under Sass in 1835, and four years later exhibited his first picture at the British Institution. In 1845 *The Village Pastor* marked his first attempt to reproduce the aspects of contemporary English life. It won for him the associateship of the Royal Academy. His *English Merrymaking a Hundred Years Ago* and his *Coming of Age in the Olden Time* added to his popularity, so that in 1851 he was elected R.A. *Ramsgate Sands* (1854), *The Derby Day* (1858), *Claude Duval* (1860), *The Railway Station* (1862), and *The Marriage of the Prince and Princess of Wales* (1865), painted for Queen Victoria, brought Mr. Frith to the zenith of his fame, when the largest price ever paid till then for the work of a living artist was given for his Johnsonian group exhibited in 1868 and sold in 1875. *Charles II.'s Last Sunday, A Private View of the Royal Academy, For Better or Worse, Dr. Johnson's Tardy Gallantry*, and *The Road to Ruin* are among his later productions, which have suffered by the change of public taste, though they are in no way inferior to his earlier achievements. Mr. Frith retired from the active duties of an Academician in 1890, and has during his later years published four pleasant volumes of autobiography.

Fritillaries, a group of butterflies, of which the most typical belong to the genus *Argynnus* and the family *Nymphalidae*; as a rule, they are brown, speckled with black, with spots of brilliant silver on the under side of the hind wings. The genus occurs in Europe, Asia, and North America. The

Duke of Burgundy Fritillary belongs to a different family, but there are seven English species of the typical group.

Fritillary (from the Latin *fritillus*, a dice-box) is the English name of *Fritillaria Meleagris*, a somewhat local liliaceous plant, growing in water-meadows, with pendulous bell-shaped flowers, which, though sometimes white, are generally of a dull red chequered very regularly in two shades of that colour. The flower is also popularly known as "snakes'-head" or "Turk's-cap." Another species of the same genus is the Crown-Imperial (q.v.).

Friuli (ancient *Forum Iulii*), a district that lies at the head of the Adriatic, the eastern portion belonging to Austria, and having Trieste as its chief place, whilst the western division falls within the Italian province of Udine. The whole of this territory, which formed under the Romans part of Gallia Transpadana, was erected into a Lombard duchy, and ultimately conquered by Charlemagne. His successors assigned it to the Archbishops of Aquileia, but the Venetians were called in by the local aristocracy, and seized the land for themselves. The Counts of Görz, however, continued to occupy the eastern extremity until Maximilian I. incorporated it with Austria. The Venetian share was acquired by the emperor through the peace of Campo Formio (1797), but was taken again by Napoleon in 1805, when Duroc was made Duke of Friuli. In 1814 Austria once more resumed possession of both parts, but ceded the western half to Italy at the treaty of Nicolsburg (1866). The territory still retained constitutes the *Italia Irredenta* that from time to time threatens the peace of Europe.

Frobisher, FORBISHER, or, and more properly, FROBISER, SIR MARTIN, sailor and navigator, was born about 1535, and, after several years of adventurous trading in the Levant and on the coast of Africa, commanded three several expeditions in search of a north-west passage, the first setting sail from Blackwall in 1576. He was captain of the *Primrose* in Drake's voyage to the West Indies in 1585, and of the *Triumph* against the Armada in 1588. For this last service he was knighted by the Lord Admiral on the deck of the *Ark Royal*. In 1590 he served under Hawkins in the expedition to the coast of Portugal; and in 1594, having been mortally wounded in an attack on Crozon, near Brest, he died at Portsmouth. He is buried in St. Giles's, Cripplegate. Frobisher Strait, one of the entrances to Hudson's Bay, was discovered by him. He also visited and charted some of the west coast of Greenland.

Froebel, or FRÖBEL, FRIEDRICH WILHELM AUGUST, was born near Blankenburg in Thuringia in 1782. His early career included some years of military service. In 1826 he published his views on education, since so widely adopted, in a work entitled *Die Menschenerziehung*. Ten years later he established at Blankenburg the first Kindergarten, afterwards moving to Marienthal, where he died in 1852. His idea of combining physical, moral, and intellectual training in a system which

should be applicable without pain or fatigue to children from the tenderest age, was derived from Pestalozzi. Though Fröbel was ridiculed in his lifetime, his principles have steadily gained ground, and a society bearing his name has been founded for their advancement.

Froebel, JULIUS, nephew of the above, was born in 1805. He made his mark first as a man of science, and became in 1833 Professor of Natural History at Zürich, where he published a treatise on crystallography. Holding strong democratic views, he promoted the Revolution of 1848, entered the Frankfort Parliament, accompanied Blum to Vienna, and was arrested. On his liberation he went to America, and subsequently settled in London, having been forbidden to return to Germany. He is the author of several works advocating Republicanism, but opposing Socialism. He died in 1893.

Frog, any individual of the genus *Rana*, with 60 species, the type of a family (Ranidae) of tailless Amphibians, containing 26 genera, with 150 species, almost cosmopolitan, and the genus is nearly as wide in its range, being absent only from South America and Australia. The name is also given to allied forms, as to the Obstetric Frog (*Alytes obstetricans*), a European species, in which the eggs are attached to the thighs of the male, which seeks the water just as the young tadpoles are about to come out. [TREE-FROG.] The Common Frog (*R. temporaria*) is found near ponds, rivers, and in marshy places all over the British Islands, and has a wide range in Europe and Asia. The male is larger than the female, and the extreme length does not exceed 2½ inches. There are four digits on the fore limbs, and five, united by a membrane, on the hind limbs, which are long and muscular, enabling these animals to take wonderful leaps. The colour is generally greenish-brown, marked with black, but alterations in the pigment cells of the skin admit of some change, and the limbs are cross-barred. The tongue is fixed in the front of the mouth, and free behind, so that it can be thrown rapidly forward, and when the prey—insects, small worms, or slugs—is secured by the viscid secretion with which it is covered, it is then so rapidly retracted that the eye can scarcely follow it. The peculiar angle in the back of the frog is caused by the fact that only the eight anterior vertebrae are separate, the rest being consolidated into one bone called the urostyle. In winter frogs undergo hibernation, generally in the mud at the bottom of ponds. The Green or Edible Frog (*R. esculenta*) has a wider geographical distribution, though it is extremely local in England. There is no black mark from the head to the shoulder, as in the Common Frog, but a light-coloured streak runs down the back. The male has large vocal sacs, and his note is much louder than that of the Common Frog, in which these dilatable sacs are absent. The name "Cambridgeshire Nightingales" is sometimes given to the edible frogs found in Foulness Mere, from their habitat and their loud croaking, just as in Holland these frogs are called "Dutch Nightingales." The hinder legs are the part generally eaten, and they

are said to resemble spring chicken in flavour. Professor Mivart calls the Frog "a martyr to science," and in this fact lies its chief interest. It is the animal on which students generally begin their dissection of vertebrates; in its transparent feet the circulation of the blood can be conveniently observed under the microscope; and to watch its development from the egg through its larval metamorphosis to the perfect animal is a practical lesson in Evolution. The larva or tadpole begins its career as a limbless, fish-like creature, living in the water, and breathing by gills; the mature form is a normal, four-limbed vertebrate, breathing by lungs. This development also throws some light on the question of what determines sex, for, by high feeding, the proportion of females to males in a hundred tadpoles has been raised from 56 to 92 per cent. [TOAD.]

Frog-hoppers, a number of small insects, belonging to the Homoptera (q.v.) and the family *Cercopidae*. The best-known English species is the "cuckoo-spit"; this is a small yellow insect with two pale bands on the fore wings; it surrounds its larva by a frothy mass, which is common on grass and bushes.

Frogmore, a mansion between the Home Park and the Great Park, Windsor, built by James Wyatt about 1800, and occupied from 1840 to 1861, the date of her death, by the Duchess of Kent, Queen Victoria's mother. Here she died, and the Prince Consort having passed away in the same year, Queen Victoria caused a mausoleum to be erected in the grounds. Besides these monuments, the estate contains the royal garden and dairy. In 1911, Queen Victoria was herself buried in the Mausoleum.

Froissart, JEAN, born at Beaumont, near Valenciennes, about 1337, his ancestors being of the *bourgeois* class. At what precise time he became a cleric cannot be ascertained. It was as a layman that he was sent, at the age of eighteen, to the court of Queen Philippa in England, whither he returned again in 1361, after diplomatic errands to Avignon and Paris. He appears to have been a favourite with Edward III.'s romantic queen, who encouraged his literary tastes and sent him to Scotland with a view to collecting materials for his rhymed chronicles. On his return he became secretary to the captive King John of France, and began to store up that curious fund of gossip information which was to delight and instruct posterity. Leaving England in 1366, he went to Brussels, to Brittany, and to Bordeaux, everywhere "interviewing" the chief actors in the great events of the day. He accompanied the Black Prince as far as Dax, but, being entrusted with a mission to England, formed part of the retinue that escorted Lionel of Clarence to Milan, travelling thither with Chaucer and meeting Petrarch at the wedding-feast. Thence he passed to Bologna, where he joined the suite of Peter, King of Cyprus, and visited Venice, going on later to Rome, where the news of Queen Philippa's death gave him a deep shock. He now made his way back to his own country, and found new

patrons in Yolande de Bar and the Duke of Brabant. For some years he settled down as a country priest in the village of Lestines, near Buiche, but, falling in with Gui, Count of Blois, was induced by him to set seriously to work on a prose history of his times, and ultimately received from his protector a canonry at Chimay. In 1386 he accompanied Gui to Blois, and journeyed next to Sluys in order to witness the preparations for a naval attack on England, and to gather matter for the Flemish part of his history. At the age of 51, but full of vigour and spirits, he set out for a tour through Berry, Auvergne, and Languedoc, ultimately attaching himself at Orthez to the generous and brilliant Gaston Phœbus, Count of Foix. On his way back to Valenciennes, where he completed his fourth book, he was present at the marriage of the Duc de Berri with Jeanne de Bourbon and at the reception of Isabeau of Bavaria in Paris. Gui de Blois had now fallen into poverty and evil habits; so Froissart transferred his allegiance to Robert of Namur, to whom he dedicated his *Chronicles*. After forty years' absence, he visited England once more, to find all his old friends gone, but to make a new one in Richard II. and to glean much useful information. He reappeared in France just before the Comte de Nevers set forth on his abortive crusade, the story of which forms almost the last chapter of the *Chronicle*, though the closing words recount the death of Richard II. in 1400. After this the fate of the historian himself becomes obscure. Tradition asserts that he died in utter poverty ten years later at Chimay, and was buried in the church of St. Monegunda. Froissart took more pride, no doubt, in his poetry than in his prose, but the samples of his verse that have been published hardly command themselves to the critical taste of later generations. His prose style, on the other hand, is remarkably vivid, simple, and effective, whilst the picture that he gives of the men and manners of the 14th century is unrivalled in accuracy and good faith.

Fromentin, EUGÈNE, was born at La Rochelle in 1820, and studied landscape painting under Louis Cabat. *Les Gorges de la Chiffa* in the Salon of 1847 brought him at once into notice, and among many other works of succeeding years may be mentioned his *Enterrement Maure*, *Voleurs de Nuit*, *Halte de Muletiers*, *Bivouac Arabe*, and *Fauconnier Arabe*, the last of which is in the Luxembourg Gallery. Equally skilful with the pen as with the brush, Fromentin produced several charming volumes of fiction and travels. *Dominique* appeared in the *Revue des Deux Mondes* in 1862, having been preceded by *Visites Artistiques*, *Simples Pèlerinages*, *Un Èté dans le Sahara*, *Une Année dans le Sahel*. He died suddenly at La Rochelle in 1876.

Fronde, the name given to a political party in France, which, during the minority of Louis XIV., resisted the tyrannical government of the Prime Minister, Cardinal Mazarin. Mazarin, himself an Italian, made himself odious to the nobility by the favour he showed to foreigners, especially his

agent, Emeri, to the people by his burdensome taxation, and to the Parlement of Paris by forcing them to register his financial edicts. *Fronde* was the name of a sling used by the urchins of Paris in their street squabbles; *frondeur* denoted a "grumbler" as well as a "slinger," and it was perhaps in this sense that the name was adopted by the leader of the party, Paul de Gondi, Cardinal de Retz. Mazarin having in 1648 arrested certain members of the Parlement, who had caused the downfall of Emeri, the Parisian mob took up arms and forced the Minister and the queen-mother, Anne of Austria, to fly to Ruel, and afterwards, in 1649, to St. Germain. The Parisians were joined by De Retz, the Duc de Longueville, Turenne, and other nobles, but the Court party were saved by Condé, who besieged Paris, and a compact signed at Ruel in April closed the struggle of the Old Fronde. The New Fronde arose simply out of the personal dislike of the great nobles for Mazarin, whom they sought to overthrow by intriguing with Spain. Condé, Conti, and Longueville were arrested in January, 1650, but Turenne marched towards Paris with a force of Spaniards. His defeat at Rethel (December) and the mutual distrust of the leaders led to the breaking up of the party. The Frondeurs returned to their allegiance, with the exception of Condé, who was defeated by Turenne near Paris (July, 1652), and at last sought refuge in Spain. The declaration of a general amnesty (1653) was followed by the return of Mazarin and the complete triumph of the royal power.

Frontenac, Louis, Comte de, was born in 1621, and, having entered the French army, became, after a distinguished military career, Governor-General of Canada in 1678. He built Fort Frontenac on Lake Ontario, was recalled to France in 1682, and died in 1698.

Frost means the condition of temperature when below the freezing-point of water. The average temperature at any spot in the British Isles is for no part of the year below freezing-point (32° Fahr.), though exceptional circumstances may bring about a period of frost extending over a large area for several days in succession. Such weather is usually settled, with high barometer and little wind. The ground in a given locality may be warm, but the air above it below freezing-point. This is the case when the growing warmth of early morning causes the heating of the layers of air nearest the ground, and a slow flow downwards of the colder upper layers. Conversely, the air may be above 32° Fahr. and the ground below that temperature, as when rapid radiation after sunset from the earth into a clear atmosphere above causes the earth to cool faster than the air. If there is but little water-vapour in the air under such conditions, the dew-point (q.v.) may be below 32° Fahr., and, that temperature being attained at night-time, dew will be deposited in the crystalline solid form. This is known as *hoar-frost* (q.v.).

Frost-bite. The circulation of the blood in the more exposed parts of the body may be so obstructed by subjection to the influence of extreme

cold, and the vitality of the tissues of the affected parts may become so depressed, that a localised mortification or *gangrene* (q.v.) results. The mortification may be the immediate effect of the exposure to cold, or may be consecutive to the inflammatory reaction which is set up in the benumbed tissues. The symptoms do not essentially differ from those of gangrene arising from other causes; if the injury to the parts be considerable, there is an actual "slough" formed, a "line of demarcation" being set up between the living tissues and those which have perished. Frost-bite is rare in Britain, though it may occur in poorly-fed and badly-clothed persons, who are exposed to extreme cold; it has been known on the Continent, however, to work great havoc in the case of an army undergoing a winter campaign. In cases of threatened frost-bite it is important not to apply warmth too suddenly to the injured part. Rubbing with snow has been found useful; and, as soon as practicable, the application of cotton wool or flannel should be resorted to, and absolute rest enforced, while the gradual re-establishment of the circulation is encouraged. If heat is applied at once, inflammatory reaction is apt to occur, and gangrene may result.

Froude, James Anthony, was born at Dartington, Devon, in 1818, being the youngest son of the Archdeacon of Totnes. From Westminster he went to Oriel College, Oxford, where his brother, Hurrell Froude, was in the thick of the Tractarian movement, with which he for a time also associated himself. He was elected to a fellowship at Exeter College, and in 1844 was ordained a deacon. A change, however, was coming over his religious views, and the publication in 1848 of *The Nemesis of Faith* led to his resignation of his fellowship and the abandonment of teaching as a career. He now joined the staff of the *Westminster Review*, devoting himself also to the collection of materials for his great work, *The History of England from the Fall of Wolsey to the Defeat of the Spanish Armada*. The first instalment of the book appeared in 1854, and the twelfth and concluding volume was published in 1870; some of his views—especially as to the elevated character and policy of Henry VIII.—proved unacceptable to popular taste, whilst the inaccuracy of his statements of fact arrayed against him the great majority of professed historians. In the meantime Mr. Froude had reprinted a selection of his most brilliant essays under the title of *Short Studies on Great Subjects*, and had accepted the editorship of *Fraser's Magazine*. In 1872 he took advantage of the new Act to rid himself of his deacon's orders, and he spent some time lecturing in the United States in support of Protestant ascendancy in Ireland. The pith of these discourses furnished a book on *The English in Ireland in the Eighteenth Century*. Lord Beaconsfield sent him in 1874 to South Africa with a view to investigating the causes of Kaffir discontent and formulating a scheme of Colonial federation. Very little resulted from his visit except *Two Lectures on South Africa*. Biographical sketches of Julius Caesar, John Bunyan, and Thomas à Becket, with some pages of memories of the High Church movement,

were all that he gave to the world during the five years preceding 1881, when, as literary executor of Thomas Carlyle, he brought out a history of the first forty years of that sage's life. Two further volumes of *Reminiscences* were followed next year by the *Letters and Memorials of Jane Welsh Carlyle*. The revelations made in these volumes gave rise to much bitter controversy. *Oceana* came out in 1886, and two years later he took for his theme *The English in the West Indies*. A novel, *The Two Chiefs of Dunboy*, was published in 1889, whilst *A Life of Lord Beaconsfield* appeared in 1890. In 1892 Lord Salisbury appointed him to succeed Freeman as Regius Professor of Modern History at Oxford. He died in 1894.

Froude, RICHARD HURRELL, the eldest brother of the historian, was born in 1803, and went from Eton to Oriel College, Oxford, where he became fellow and tutor. A close friend of Newman and Keble, he entered with ardour into the Tractarian movement, and wrote Nos. IX. and LXIII. of the *Tracts for the Times*. His impressionable nature, wrought to feverish excitement by the consumptive tendencies that undermined his health, carried him more rapidly forward than his contemporaries, and the publication of his writings after his premature death, in 1836, gave a more distinctly Romanising aspect to the Oxford reform than it had as yet assumed.

Froude, WILLIAM, brother of both the foregoing, was born in 1810, and, after being educated at Westminster and Oriel, where he took a first class in mathematics, adopted the profession of civil engineer. As Mr. Brunel's assistant, he helped to make the Bristol and Exeter Railway, but retired in 1846 from the active exercise of his profession, and devoted himself to investigating the laws that govern the stability of ships and the best means of overcoming the resistance to speed offered by the friction of water or air. A long series of experiments led him to conclusions that have been of the highest value to naval constructors. He was consulted by the Admiralty, especially as regards the building of the *Dreadnought* and the *Inflexible*, and served on the committee of 1871 to inquire into the designs of ships of war. He died in 1879.

Fructose. [LEVULOSE.]

Fruit, a term used generally in a very loose sense for the structures that follow the flower in the higher plants, especially when they are succulent or sweet, and sometimes extended even to other parts of the plant. A strawberry, a mulberry, a fig, or a pineapple are usually called fruits, and even a tart made from the leaf-stalks of the rhubarb is sometimes thought of as a fruit-tart, whilst we hesitate to apply the term fruit to a nut, a pea-pod, a grain of corn, a poppy-head, or a vegetable marrow. Botanically, however, a fruit may be best defined as the fertilised gynæcium of a flower, together with those adjacent structures (belonging to the same flower) that enlarge and adhere to it in consequence of fertilisation. Such "polythalamic" structures as the mulberry, the fig, and the pine-apple, which not only involve other parts than

the gynæcium, but are also each made up of many flowers, may well be kept apart under the name of *infructescences* (q.v.). Among "monothalamic" structures—i.e. those formed from a single flower, we may distinguish *true fruits*, those consisting solely of gynæcium structures, from *pseudocarps*, those to which other parts contribute. The walls of the fertilised ovary in the former are termed the *pericarp*, and this consists of three layers often readily distinguishable, the *epicarp* (q.v.), *mesocarp* (q.v.), and *endocarp* (q.v.). In pseudocarps the other structures contributing to the fruit are mainly derived from the floral receptacle. In the strawberry (q.v.), for instance, the numerous carpels, constituting the apocarpous (q.v.) and polycarpellary gynæcium are scattered spirally over a fleshy outgrowth from the conical white receptacle. No such structure is present in the buttercup or the raspberry, or even in the closely-related genus *Potentilla*. In the rose (q.v.) the dry, apocarpous, one-seeded carpels are enclosed in a red, fleshy, urn-shaped, receptacular tube. In the apple, the cucumber, and all fruits formed from "inferior" ovaries, the true fruit or gynæcium is surrounded by the adherent receptacular tube, which often forms much of the fleshy portion. The terms pericarp, epicarp, mesocarp, and endocarp can hardly be properly applied to these pseudocarpic structures.

After fertilisation (q.v.), or even after pollination, the ovary or ovaries commonly increase in size; and, whilst the petals, stamens, and sometimes the sepals, fall off, nourishment is determined towards the gynæcium. This enlargement of the ovary sometimes takes place, mainly among cultivated races of plants, without fertilisation, as in the sultana raisin and in the seedless varieties of the apple and of the Maltese orange. In annuals, biennials, and those other plants, such as *Aloc* and *Agave* (q.v.), which, producing only one crop of flowers and fruit in their lives, are termed *mono-carpic*, as the fruit ripens the whole plant withers, exhausted by the great physiological effort of seed-production. In ripening, the ovary or other structures either dry up or wither, like autumn leaves, or become fleshy. In the former case the fruit, if containing more than one seed, is commonly *dehiscent*, splitting, that is, either into one-seeded portions or *cocci*, which do not themselves split [*SCHIZOCARP*], or so as to discharge its seeds. Fleshy fruits, on the other hand, are mainly *indehiscent*. They commonly change colour, turning from green to some shade of red, yellow, or, more rarely, purple, by modification of their chlorophyll (q.v.), and at the same time convert much of their acid contents into sugar.

Some fruits are furnished with wing-like projections of the pericarp [*SAMARA*], and others with a "pappus" of hairs [*CYPSELA*], by means of which they are carried by the wind beyond the stifling shade of the parent plant. Some dehiscent fruits—such as those of the balsams, and, to a less extent, broom and furze—split so elastically as to throw their seed some little distance. Fruit-eating birds do not, as a rule, have muscular gizzards, and frequently swallow seeds whole and pass them undigested; but, whilst their seeds are almost always

indigestible, succulent fruits, such as apples, are attractive to other animals besides birds—deer, for example. Even the dry fruits of grasses have been observed to be thus disseminated, after being swallowed, by locusts. Many fruits are furnished with curved hooks, which become entangled in the wool or hair of animals, and may thus cause them to be conveyed long distances; whilst the stony pericarp of some fruits will for some time resist the action of sea-water.

Fruits have been variously classified, and a great variety of names applied to the different forms, many of which can, however, be neglected, as only of exceptional application. No classification can hope to be altogether natural, since succulence and such types as the capsule have undoubtedly originated more than once in independent groups. Omitting exceptional cases, the following strictly morphological classification of the chief forms, most of which are described under separate headings, may be adopted. Less common fruits, not falling under one of its headings, may be described by derivative adjectival terms, such as *drupaceous*, *capsular*, *samaroid*, etc.

MONOCARPELLARY (of one carpel)—

- Dry. 1. Legume (*Leguminosae*).
- Succulent. 2. Drupe (*Drupaceae*).

POLYCARPELLARY (of more than one carpel)—

- (a) Apocarpous (with distinct carpels)—
 - 8. Eterio : i. of follicles (*Magnolia*).
ii. of achenes (*Ranunculus*, rose, strawberry).
 - iii. of drupels (*Rubus*).

(b) Syncarpous (with united carpels)—

* Superior—

Dry—

Dehiscent, exposing seeds ...	{ 4. Siliqua (<i>Cruciferae</i>).
	5. Capsule.
Dehiscent, not exposing seeds	6. Regma, or superior Schizocarp (<i>Geraniaceum</i>).
Dehiscent, winged ...	7. Samara (Maple).
Indehiscent ...	8. Caryopsis (Grasses).
Succulent ...	9. Nuculane, Uva, or superior Berry (Grape, Orange).

** Inferior (necessarily more or less pseudocarpic)—

Dry—

Dehiscent, exposing seeds ...	10. Diplotegium or inferior capsula (<i>Iris</i>).
Dehiscent, not exposing seeds	11. Cremocarp, or inferior Schizocarp (<i>Umbelliferae</i>).
Indehiscent ...	12. Cypselia (<i>Compositae</i>).
	13. Nut (<i>Cupuliferae</i>).

Succulent—

Thin-skinned ...	14. Berry (Gooseberry).
Thick-skinned ...	15. Pepo (<i>Cucurbitaceae</i>).
With a core ...	16. Pome (<i>Pomaceae</i>).

Here the first nine types are all superior, and almost exclusively gynoecial in structure; in the first three there is no cohesion of carpels; in each subdivision the simpler dry types precede the succulent, and the more dehiscent precede the less. Perhaps it might be well to lump the siliqua with the capsule, the winged samara with the unwinged regma, and the cypselia with the very slightly differing nut; but, as shown by the examples named in the table, these types are characteristic of important natural orders, and their names are in familiar use among systematists.

Fruit Bat. [BAT, FLYING FOX.]

Fruit Pigeon, any bird of the genus *Carpophaga*, with 50 species, from the Oriental and Australian regions.

Fruit Sugar. [LEVULOSE.]

Fruit Trees and Fruit Growing. [Horticulture.]

Frumentius, the founder of the Christian Church of Abyssinia, and known to his followers in that country as Abba Salama, "Father of Salvation," is a personage of whom little is known. According to tradition, he went out to India with two other missionaries about the middle of the 4th century, and obtained the favour of the king of that uncertain region. Returning to Alexandria, he was consecrated Bishop of Axum in Abyssinia by Athanasius, who mentions this fact in his letters. Some have thought that South Africa was the field of his labours, but there is little evidence to controvert the direct statement of Athanasius himself.

Frustum, in solid geometry, signifies that portion of a solid contained between any two planes of section. In the case of a cone or other pyramid the base forms one plane of section, the other being taken anywhere between the base and the apex; the term is still further particularised, if no inclination of the second plane of section is mentioned, to refer to that portion between the base and any plane section *parallel* to the base. A frustum of a sphere or other conicoid similarly means the volume between any pair of parallel plane sections.

Fry, MRS. ELIZABETH, the daughter of John Gurney, a wealthy Quaker of Norwich, was born in 1780. At the age of eighteen her religious fervour was roused by the preaching of Savory. She married Joseph Fry, a London merchant, in 1800, and, though she had a large family, contrived to devote much of her care to the poor of her neighbourhood. Her charity and her simple eloquence won for her the position of minister amongst the Friends. About 1813 her attention was directed by Howard's example to the appalling features of prison life. Four years later she established the Association for the Improvement of Female Prisoners in Newgate, and in 1819, together with her brother, Joseph, visited the criminal establishments in the north and in Scotland. Her benevolent work was recognised by Parliament, and soon bore excellent fruit. In 1827 she made a tour of inspection in Ireland, and extended her observation to lunatic asylums and hospitals. The whole of Europe now awoke to its responsibilities, and from 1838 to 1842 Mrs. Fry was engaged in inquiries, which took her over France, Switzerland, Belgium, Holland, Prussia, and Denmark. Unremitting toil then told upon her health, and in 1845 her noble life of self-sacrifice was brought to an end. Her *Memoirs, Journals, and Letters* were edited in 1847 by two of her daughters.

Fryzell, ANDERS, was born in Dalsland, Sweden, in 1795. He graduated at Upsala, entered the pastorate, and adopted education as his profession. His first published work was entitled *Svensk*

Spraklara, but his fame chiefly rests on his *Berättelse ur Svenska Historien*, which appeared in parts for upwards of five-and-twenty years, and at once achieved popularity. From 1833 to his death in 1881 he was professor at Upsala, and also parish priest of Sunne.

Fuad Pasha, MEHMED, born at Constantinople, in 1814, of wealthy and distinguished family, was compelled, owing to the confiscation of his father's property, to adopt a profession. Having studied medicine, he obtained a post in the Admiralty, but abandoned it to enter the diplomatic service. He served as first secretary in London from 1840 to 1843, and, after filling several other positions with credit, became Foreign Minister in 1852, resigning next year owing to a misunderstanding with Prince Menschikoff as to the Holy Places, which ultimately resulted in the Crimean War. He served as Commissioner with Omar Pasha's army, but in 1855 resumed his charge of the Foreign Office. President of the Tanzimat in 1857, he was sent in 1860 to make peace between the Druses and Maronites, and soon after was made Grand Vizier. In 1867 he visited England in the suite of the Sultan, and in 1869 he died at Nice.

Fuca, THE STRAITS OF ST. JUAN DE, connect the Pacific Ocean with the Gulf of Georgia, S. of Vancouver's Island. The channel was for long supposed to lead into the North Atlantic, but Vancouver, at the end of the 18th century, set the question at rest. These straits form part of the boundary between the United States and British North America, and in 1872 the Emperor of Germany, as arbitrator, assigned the Island of St. Juan to the first-named Power.

Fuchsia, a genus of plants, comprising upwards of 50 species, belonging to the order *Onagraceae*, named by its discoverer, Plumier, after the German botanist, Leonhard Fuchs (1501-1566). They have simple leaves, usually in opposite pairs; pendulous flowers with an inferior ovary; a funnel-shaped, coloured, deciduous calyx of four valvate sepals; four perigynous, convolute petals, generally different in colour from the sepals; eight exserted stamens; a long style; and a four-chambered berry. Three species are known from New Zealand, one from the Falkland Islands, and the remainder from the forests or mountains of Chili, Peru, and Mexico. The globe-flowered *F. coccinea* was introduced into England in 1788; the long-flowered *F. fulgens* in 1837, and since then innumerable hybrids of these and other species have been raised. Fuchsins may be readily grafted, and grow to a large size and are perfectly hardy on the south-west coasts of England. The berries of some kinds are edible but insipid.

Fuchsine, a dyestuff known also under the names of *Magenta*, *Rosine*, *Ponceau*, and others. It consists of the hydrochloride (or acetate) of *rosaniline* (q.v.), and has the composition $C_{20}H_{10}N_3HCl$ (or $C_{20}H_{10}N_3C_2H_4O_2$). It forms fine crystals of a metallic green colour, which dissolve to a carmine red solution. The dyes, known as cerise, cardinal, and many others, contain this

substance among their constituents. For dyeing cotton, the fabric should be "mordanted" [DYEING] with tannic acid, but wool and silk require no mordant.

Fucino, or CELANO, LAKE (classic *Lacus Fucinus*), is situated in the province of Aquila, South Italy, 15 miles N. of Sora. Lying between two ranges of the Apennines at a height of 2,276 feet above the sea, and having a length of 10 miles and a breadth of 7 miles, it has always been a source of danger through inundation to the valleys below. The Emperor Claudius drew off the overflow by means of a tunnel to the river Garigliano, but this outlet became blocked, and was only cleared in 1862 at immense cost by a Neapolitan company.

Fucus, an important genus of olive-brown seaweeds, giving its name to the order *Fucaceæ*, and including the common bladder-wracks (*F. vesiculosus* and *F. nodosus*), which cover so large an area of the tidal rocks of our coasts. They have a flat thallus, branching in one plane, often with large air-bladders hollowed out of their tissue as floats. The only known method of reproduction is sexual, the antheridia and oogonia being, either together (monoecious) or separately (diœcious), in globular cavities, known as *conceptacles*, sunk in the warty extremities of the branches. The antheridia are lateral or branched hairs (*hyphae*), and the protoplasm of each ovoid antheridium breaks up into numerous pointed and laterally biciliate antherozoids. The oogonia terminate short hyphae, and their contents break up into eight relatively large oospores. These escape from the conceptacle through its *ostiole* or mouth into the water; are impregnated by numerous antherozoids, the cilia of which impart to them for a time a rolling movement; and, acquiring a cell-wall and settling down, germinate by cell-division without any resting period. They are largely used in the manufacture of kelp (q.v.) as a source of iodine and as a manure. *F. vesiculosus* is the badge of the clan M'Neill.

Fuegians, the inhabitants of Tierra del Fuego, of whom there are three distinct ethnical groups:—(1) The *Onas* in the east (King Charles South Land), who are Patagonian intruders from Argentina; (2) the *Alacalufs* in the west, intruders from the Chilian Cordilleras, and akin to the Araucanians of that region; (3) the *Yahgans* of the southern islands, who are the true aborigines of the archipelago; total population, 8,000, of whom 2,000 are Onas, 3,000 Alacalufs, and 3,000 Yahgans. Of these groups the Yahgans have come into most frequent contact with explorers, and to them alone missionary work has hitherto been extended. Hence most of the published accounts of the Fuegians refer to these aborigines, who are at an extremely low grade of culture, and of a debased physical type, characterised by small stature (4 feet 10 inches to 5 feet 4 inches), low brow, high cheek bones, flat nose, tumid lips, dark chocolate colour, loose, wrinkled skin, black, restless eyes very widely apart, coarse, black, lank hair, head and chest disproportionately large compared with the slender and outwardly

curved legs. The mental qualities are at the same low level, as shown by the brutal treatment of their women, who, when old and useless, are often eaten ; by the lack of affection for their offspring, who in rough weather are cast overboard either to propitiate the storm-gods or to lighten the canoe ; and by many repulsive practices connected with their food and social habits. There is no tribal or social organisation, each family circle living apart with no hereditary or even temporary chiefs. The language, which shows no affinity to any other American idiom beyond its general polysynthetic structure, has root words only for the first four numerals ; it has been reduced to writing by the English missionaries, who issued a translation of St. Luke in a peculiar script in 1881. (Darwin, *Voyage of the "Beagle;"* W. Parker, *The Wild Tribes of Tierra del Fuego,* in *Transactions of the Ethnol. Soc.,* 1861 ; *South American Missionary Magazine, passim* ; Lieut. Bove, in Guido Cora's *Cosmos*, 1883 ; A. H. Keane, art. *Tierra del Fuego*, in *Encyc. Brit.*, new ed.)

Fuels. The term "fuel" is generally understood to include all substances the combustion or burning of which is practically utilised for the production of heat. It therefore includes a large number of substances, which may be conveniently divided into *solid, liquid, and gaseous fuels*. Under the first class are included wood, peat, charcoal, coke, the various varieties of coal, together with a number of manufactured products called "patent fuel." Of liquid fuels, petroleum is by far the most important ; while coal-gas, natural, and waste furnace gases are the gaseous fuels in most common usage. The value of any fuel is largely dependent upon its *calorific power*—*i.e.* the weight, in pounds, of water which can be raised through one degree Centigrade by the heat evolved by the combustion of one pound of the material. This is usually determined practically, but it may be generally approximately calculated from a knowledge of the chemical composition of the substance. The *calorific intensity* of a body is the maximum temperature theoretically obtainable by the combustion, and it is evident that for many purposes a high intensity is of more importance than great calorific power. It evidently depends upon the latter, but is also affected by the quantity and nature of the products of combustion, high specific heat in these products diminishing the intensity. Thus, although the calorific power of hydrogen is four times that of carbon, the intensity is much less owing to the high specific heat of the water formed by its combustion. Other considerations, however, also enter into the actual utility or value of fuels, as *e.g.* the ease with which combustion is started, and the mode in which it progresses, the size of the flame, cleanliness of the fuel, its ease of working, quantity of ash, bulk, nature of the products of combustion, and other details of a more or less practical nature.

Wood is very useful as a fuel for domestic purposes, when it can be obtained cheaply. In large towns, however, its cost and bulk render it unsuitable, while also, owing to the large amount of moisture contained, it is not well adapted for

metallurgical operations where high temperatures are required. Still in many parts of the Continent dried wood is used to a large extent even in metallurgy.

Peat is a product of the decay of plants, chiefly mosses, in marshy regions. Its composition is intermediate between those of wood and coal. Where it occurs plentifully it is frequently used, but is almost entirely restricted to these districts, and to domestic usage, for the same reasons as apply in the case of wood.

Coal, in its different varieties, as *lignite, bituminous, anthracite, etc.*, forms by far the most important fuel. It is very largely employed both for household and manufacturing purposes. The composition of coal, neglecting the ash, varies from carbon 70 per cent., hydrogen 5 per cent., and oxygen 25 per cent., in lignite ; to carbon 95 per cent. and hydrogen and oxygen 2·5 per cent., each in anthracite ; while the quantity of the ash varies from 50 to 2 per cent.

Coke and *charcoal* are obtained by heating coal and wood respectively, without access of air. They both give high temperatures by their combustion, and burn with clear flames, depositing no soot. They are hence well adapted for metallurgical operations, in which they are largely employed, but are also used for domestic purposes, especially on the Continent.

"*Patent Fuel.*" The various forms of patent fuel consist generally of "small coal," mixed with some substance necessary to give coherence to the mass. For this purpose pitch, tar, asphalt, treacle, etc., have been employed, but as yet none have proved entirely satisfactory.

Petroleum. This includes a large number of mineral oils, which occur naturally, principally in America and Russia. It is burned either in troughs or as a spray formed by means of a blast of steam or hot air. It is also much used for production of gas, which is then burned. Owing to its cleanliness, ease of working, and to its occupying a smaller bulk than coal, it forms, wherever plentifully obtained, a very economical fuel.

Natural Gas, *i.e.* the gases which emanate from the soil or from bore-holes, chiefly in the petroleum districts, more especially in Pennsylvania. Within the last ten years the use of natural gas has very largely increased for purposes of heating or illumination. Thus, at Pittsburg over 250,000,000 cubic feet of gas are at present delivered daily, the bore-holes or wells numbering over 100, while the wells in some places have yielded a continuous and apparently undiminished supply for years.

Coal Gas. Producer gases, obtained by heating coal (or other fuel) in chambers known as *producers*, have been used for many years for the heating of steel furnaces. Latterly, however, the use of ordinary coal-gas for domestic purposes, as in stoves, etc., has also been largely increasing.

Waste Furnace Gases, *i.e.* the gases escaping from blast furnaces, contain usually a fair percentage of the combustible carbon monoxide, CO, and are used frequently in manufacturing operations, where a high and constant temperature is not an essential.

Fuero, in Spain, a word used in the sense of a collection of laws. It was applied to the Visigothic code (*Fuero Juzgo*), when it was translated from the Latin, but it usually denoted a charter granting municipal privileges, a meaning which was afterwards extended so as to cover all forms of local self-government. Some fueros, or at least the rights confirmed by them, seem to date from the Roman period, and to have remained undisturbed during the Visigothic occupation. The earliest fuero in the form of a written charter—that granted to Leon in 1020—comprises both a *fuero general* for the province and a *fuero municipal* for the town, both embodying much earlier rights. With the progress of monarchy in Spain, and the concentration of all power in the king's hands, most of the fueros disappeared, but those of Navarre and the Basque provinces were preserved till within a recent period. A fuero always provided for some form of self-government by means of a freely-elected assembly, such as the Cortes of Navarre and the Juntas of the various Basque provinces, subordinated to a Junta General, which met under the oak of Guernica in Biscay. In the Basque provinces the administrative body consisted of a corregidor, who represented the king, and two deputies and six regidors, appointed in the Junta-General. The privileges of these provinces, which in the main resembled those of other districts possessing fueros, included self-taxation, an independent system of jurisdiction, almost complete freedom of trade, and the control of their own military forces, with exemption from liability to serve in the Spanish army. The Basque fueros were suppressed in 1833, and, though restored by Isabella in 1839, were finally abolished after the Carlist rebellion in 1873-76. The word *fuero* has yet another sense, denoting the customs regulating land-tenure, inheritance, etc., which varied greatly in different localities.

Fuerteventura, one of the Canary Islands, not quite so mountainous as the others of the group. Its capital is Betancuria; it has an area of about 750 square miles.

Fugger, the name of a Swabian family that rose from humble mercantile position to princely rank. JOHN FUGGER, the founder of the house, was a master-weaver at Graben, near Augsburg, a member of the Westphalian Vehingericht, and a fairly prosperous citizen, who died in 1409, leaving a modest fortune. His eldest son, ANDREW, was the progenitor of the noble Fuggers vom Reh, extinct for over three centuries. The second son, Jacob, remained a weaver, but accumulated a large fortune that was shared by three brothers, ULRICH, JACOB, and GEORGE. All were ennobled by Maximilian in return for timely loans, and together they built the famous almshouses known as the Fuggerei at Augsburg. George alone handed on the name and business to the next generation, and his two sons, RAIMOND and ANTONIUS, were the wealthiest men of their day and strong opponents of the Reformation. Charles V. stayed in the house of the latter at the Diet of Augsburg in 1530, and was warmed by a fire of cinnamon kindled with his own hand. Such

generous hospitality met with its reward, and the brothers were not only made princes, but received large grants of land and the privilege of issuing currency. Antonius died in 1560, leaving six millions of gold crowns as well as vast landed estates all over the world. The families of both still exist as the Fuggers of Kirchberg and Weissenhorn, enjoying the highest hereditary honours in Bavaria and Austria, and being allied by marriage with the best blood in Germany.

Fugitive Slave Laws, laws passed by the United States of America, enacting that slaves who escaped from one state, where they were legally held to "service," into another, should be given up, when claimed by their owners. The original Act of 1793 gave place in 1850 to a harsher measure, which compelled the citizens of a state to give active assistance in the reclamation of slaves, and made it a penal offence to aid their escape. The law was repealed in the course of the Civil War.

Fugue (Latin *fuga*, flight), a musical composition, in which a subject, introduced by one part, is copied successively by the other parts in accordance with certain rules. After its introduction by the first part, the subject is repeated by the second part either in the fourth or fifth, while the first part is so arranged as to agree with it, both parts being so regulated that the first cadence may be on the fifth of the key. The subject is then resumed in the same part as at the commencement, but by a different interval, and after a rest of a whole or half a bar, or even longer. The second part is brought in before the first part is concluded, the second cadence being in the third of the key. Finally the subject, being introduced by either part, is taken up sooner than at first by the other part, and the parts are then united and brought to a close by a final cadence. There are various forms of fugue—such as *fuga doppia*, "double fugue," in which two subjects begin at once in different parts; *fuga homophona*, in which the answer and imitation of the subject are in unison; *fuga irregularis*, "free fugue," in which the subject is not treated according to the strict laws of fugue-writing, etc. Vocal fugues are subject to the same rules as those written for instruments. Sebastian Bach holds the most distinguished place amongst fugue-writers. These include all the eminent composers of both old and modern times, but none of them has approached him in this branch of music.

Fujisan, a volcano in the island of Nippon, Japan, where it is regarded as sacred. It attains the height of 14,127 feet, and is conspicuous from Tokio, the capital, whence it is about 60 miles distant.

Fulahs (properly PULO, PULLO, plural FULBE), one of the great nations of Central Africa, who have been politically dominant in West Soudan and Adamawa since the close of the 18th century, when the Hausa states were overthrown [HAUSA], and the Fulah empire of Sokoto founded by the Mohammedan reformer, Dan-Fodio (Othmân Dan-Fodî). The name occurs under many variants, such as *Fila* of the Mandingans. *Fula*, *Fellani*,

Fellanchi of the Hausas; **Fulāta**, **Fellāta** of the Kanuri (Bornu); **Afut**, **Ifulan** of the Southern Tuaregs (Berbers), **Afellen**, **Ifellen** of the Northern Tuaregs; **Fullán**, **Fellāta** of the Arabs; **Fulah**, **Fuli**, **Poul**, **Poul** of European writers, besides **Pular**, **Fulfulde**, and other erroneous forms. The original seat of this remarkable people, at least in historic times, are the two districts of Futa-Toro on the left (south) bank of the Senegal river from Falemmé to the coast, and Futa-Jalon (Fuladugu) in the Upper Senegal basin. Here alone are found large, unmixed Fulah populations; here alone the Fulahs have preserved their racial purity; here dwell, or originally dwelt, the *Jel*, *Baa*, *Su*, and *Beri*, who, according to the national genealogies, form the four great branches of the Fulah race; lastly it was from these districts that the Fulahs under their fanatical leader, Dan-Fodio, overran a great part of Soudan, reducing innumerable petty Moslem and pagan states, establishing their political supremacy from the Niger to Lake Chad, and founding a vast number of scattered pastoral Fulah communities throughout the whole of West and Central Soudan as far east as Wadai and Dar-For. This great wave of political conquest, religious propaganda, and social migration has thus spread in the direction from west to east, though the race itself appears to have moved in remote prehistoric times from the east or north-east westwards to their present homes in the Senegal basin. Barth brings them from the oases south of Morocco and Twt; and, if his view be correct, they may be identified with the Leukethiopians ("White Ethiopians") whom Pliny places south of the Mauritanian Gætulians between the Libyo-Egyptians and the Negroes north and south. Their widespread diffusion eastwards has been followed by extensive intermingling with other peoples, so that the Fulahs of Gondo, Sokoto, Adamawa, and other regions are not now always distinguishable from the surrounding Negro and Negroid populations. But when studied in Futa-Toro and Futa-Jalon, where they have kept aloof from the neighbouring Senegambian aborigines, the Fulahs are at once seen not to be Negroes. De Guirodon, who knew them well, speaks of their reddish-brown or light chestnut complexion, crisp but not woolly hair, straight and even aquiline nose, regular features, small, slim, and shapely figures, small, well-formed, and other traits which separate them entirely from the Negro, and seem to affiliate them rather with the Hamitic (Berber). But if they are originally Hamites, they have lost their Hamitic speech, the Fulah language belonging distinctly to the agglutinating order common to nearly all the Soudanese Negroes. Some of the grammars, however, composed by Reichardt, Krause, and others profoundly ignorant of this idiom, have given rise to strange misconceptions regarding its true character. (Capt. Th. Grimal de Guirodon, *Les Puls*, 1887; R. M. Macbriar, *Grammar of the Fulah Language*, 1854; General Faiderbe, *Grammaire, etc., de la Langue Poul*, 1882.)

Fulcrum, in any form of lever (q.v.), is that point of the instrument which is held in a fixed

position. Levers are conveniently classified according to the position of the fulcrum in relation to the points of application of the force applied by the operator and of the load.

Fulda, a fortified town in the province of Hesse-Nassau, Prussia, on the right bank of the river Fulda. Here St. Boniface founded early in the 8th century, through the agency of Sturmius, a great Benedictine monastery, which, like Tours in France and Iona in Scotland, became the centre of missionary work for all Germany. The prince-bishops of Fulda were in 968 recognised as primates of the Teutonic abbeys; but in the following century the power and character of the foundation declined, and has never been recovered. The cathedral now extant is the fourth that has been built on the site of the original structure, where Boniface was buried. The episcopal palace and several seminaries also testify to the past importance of the town, which is dependent for its modern prosperity on the manufacture of woollen and linen goods, earthenware, and tobacco.

Fulham, a suburb of London, on the Middlesex bank of the Thames, opposite Putney, and $5\frac{1}{2}$ miles from St. Paul's. Long before the Conquest Fulham was associated with the see of London, and in the reign of Henry VII. Bishop Fitz-james built the modest red-brick palace in which his successors still reside for a portion of the year. The gardens of 40 acres, surrounded by a moat, are scarcely inferior to those of Lambeth. The parish church of All Saints in the Decorated English style is full of interesting monuments from that of Dr. Butts, Henry VIII.'s physician, down to the tomb of Theodore Hook. Fulham contains an orphanage, a reformatory, and manufactories of pottery and other goods. Its population is rapidly increasing, and by the Reform Bill of 1885 it is constituted a separate borough, returning one member. Pop. (1901), 249,534.

Fulica. [COOT.]

Fuligula. [POCHARD.]

Fuller, ANDREW, the son of a small farmer, was born at Wicken, Cambridgeshire, in 1754. Whilst helping in the work of the farm, he began to preach to the Baptist congregation at Soham, and in 1775 was ordained as pastor there. In 1782 he was transferred to Kettering, where he had the advantage of meeting with some of the leading Nonconformist thinkers. His views now broadened, so as to lead him away from hyper-Calvinism, though he never swerved from the cardinal doctrine of salvation by grace. To advance his opinions he published *The Gospel Worthy of All Acceptation*, and after twenty years of controversy secured something like a triumph. *The Gospel Its Own Witness* is a more purely theological treatise directed against Socinianism, whilst several other volumes and pamphlets give proof of his earnest purpose and active mind. His greatest achievement was the establishment, in 1792, of the Baptist Missionary Society, over which he exercised unremitting watchfulness till his death in 1815.

Fuller, Thomas, D.D., was born at Aldwinclie, Northamptonshire, in 1608. Possessing excellent abilities, he went to Queen's College, Cambridge, where his uncle was president, and took his M.A. degree in 1628. For a year or two he held a curacy in Cambridge, but in 1631 he received a prebend in Salisbury, and, soon afterwards, the rectory of Broadwindor, Dorset, where he spent six years in parish work and in composing *The Holy War*, in which he deals with the Crusades, and *The Holy and Prophane States*, a series of character sketches. Meanwhile his own social qualities and literary merits, with the help of family interest, had brought him into prominence as a popular London preacher and a member of Convocation. In 1640 was published his first volume of sermons, *Joseph's Parti-Coloured Coat*, and in that year he married. He was sent to Oxford with the Westminster Petition (1643), but his mission broke down. That year also witnessed the death of his wife and his own flight to the king at Oxford. He showed his devotion to the cause by joining Lord Hopton's regiment as chaplain, and he subsequently took part in the defence of Basing House, whence he proceeded to Exeter, and spent two years in that city. During this period he was assiduously collecting materials for his *Church History* and his *Worthies of England*. He now came to terms with the Parliamentarians, and returned to London, where in 1646 he brought out his *Life of Andronicus*, a veiled satire on the Roundhead leaders, and followed it up with *Goud Thoughts in Worse Times, The Wounded Conscience*, and a translation of the *Annals of Ussher*. Lord Carlisle now gave him the curacy of Waltham Abbey, and here he settled down to his great task—the completion of the *Church History*, which appeared in 1655. Before this he had composed *A Pisgah-Sight of Palestine* (1650), and was attacked by South and Peter Heylin. The Hon. George Berkeley gave him the living of Crawford in 1658, and next year was printed his reply to Heylin under the title *The Appeal of Injured Innocence*. The proposal to institute an oath of fealty to the Commonwealth drew from him, in 1660, *An Alarm to the Counties of England and Wales*, and *Mist Contemplations in Better Times*, wherein the approaching Restoration was plainly foreshadowed. He visited Charles II. at the Hague just before that event, which he celebrated in a poem entitled *A Panegyric to His Majesty on his Happy Return*. His preferences were at once restored to him, but he did not enjoy them long, for an attack of typhus carried him off in 1661, before he had prepared the *Worthies* for the press. He was remarkably free from narrow prejudice and imbued with shrewd practical wisdom as well as with a love of goodness and truth.

Fuller's Earth is a clay or marl which generally occurs associated with chalk or oolite formations. It has a soft, unctuous feel, and has a specific gravity of 1·8 to 2·2. It is used in the cleansing of cloth—fulling—as it extracts the greasy materials employed in the preparation of the wool. It varies in colour from blue to yellow,

and its composition generally approximates to the following:—Silica, 60 per cent.; alumina, 10 per cent.; oxides of iron, 5 per cent.; lime, 6 per cent.; magnesia and alkaline compounds, 4 per cent.; water, 15 per cent.

Fulmar, any bird of the cosmopolitan genus *Fulmarus*, with 40 species. The Fulmars are gull-like petrels, with the characters of the family (*Procellariidae*); the bill is strong and hooked, and bears the nostrils united in a single tube; the wings are long and well adapted for swift and sustained flight, for these birds rarely return to land except for nesting, or when driven there by gales; and the hind toe is replaced by a claw. The common Fulmar, or Fulmar Petrel (*F. glacialis*), has its home in the Arctic regions, sometimes straying to Britain, and it is said to nest in St. Kilda. The length of an adult male is about 16 inches, and the summer plumage of both sexes is white on the under surface and bluish-ash above. They feed on fish, molluscs, offal of any kind, and are said to pick the parasites from the skin of living whales. Fulmars are important to the natives of Northern and Arctic Europe for their feathers, down, flesh, and oil. This oil has a peculiarly strong odour, and the birds discharge it as a means of defence.

Fulminates are metallic salts of a hypothetical fulminic acid (q.v.), or fulminate of hydrogen, and all explode violently when struck or heated. The salt most commonly used in explosives is fulminate of mercury.

Fulminating Gold. A compound of the composition $\text{Au}_2\text{O}_3(\text{NH}_3)_3$, the preparation and properties of which have been long known, being described by Basil Valentine in the 15th century. It is best prepared by the action of ammonia upon gold hydroxide $\text{Au}(\text{OH})_3$. It is a greenish brown powder, which explodes very violently upon percussion or heating.

Fulminating Mercury, or **FULMINATE OF MERCURY**, is a white crystalline solid of specific gravity 4·4, which dissolves in hot but not in cold water. It explodes violently when struck or heated, or subjected to the electric spark, the violence of the explosion being greater than that of an equal quantity of gunpowder. It is prepared by dissolving mercury in nitric acid and then adding alcohol, but its preparation is attended with considerable danger. It has the composition $\text{C}_2\text{HgN}_3\text{O}_2$, and is used in the manufacture of detonators for nitro-glycerine etc., and of percussion caps.

Fulminating Silver, or **FULMINATE OF SILVER** ($\text{C}_2\text{Ag}_3\text{N}_3\text{O}_2$), is prepared in a similar manner to that employed for the mercury compound. It forms white, needle-like crystals possessing a bitter taste. It explodes with extreme violence at very slight disturbances, as e.g. rubbing with a glass rod, even under water. It is soluble in ammonia, forming an ammonium silver compound $\text{C}_2(\text{NH}_4)\text{AgN}_3\text{O}_2$, which is even more violently explosive than the silver compound itself. It should be needless to state that the preparation should never be attempted except by those *perfectly* conversant with

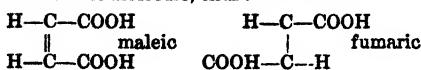
its properties, as the precautions absolutely necessary to prevent most dangerous explosions are extremely numerous and delicate. It is used in cracker bonbons. The term fulminating silver is also applied to an explosive compound of composition $\text{Ag}_2\text{O.NH}_3$, prepared similarly to fulminating gold.

Fulminic Acid. It is doubtful whether this acid, corresponding to the *fulminates*, has been really prepared. It appears to be produced by the action of sulphuric acid upon ammonium fulminate. It thus forms a crystalline solid melting at 40°, of composition $\text{C}_2\text{H}_4\text{N}_2\text{O}_3$; its constitution has been a subject of much discussion among chemists.

Fulminuric Acid, a white crystalline solid, salts of which can be obtained by boiling fulminating mercury with an alkaline chloride. The acid itself can be obtained by action of sulphuretted hydrogen upon the lead salt. It has the composition $C_3H_4N_3O_3$, but its constitution is as yet unknown.

Fulton, ROBERT, an American engineer, born in 1765 at Little Britain, Pennsylvania, began life as a portrait and landscape painter, but, visiting England in 1787 to obtain lessons from Benjamin West, became influenced by the Duke of Bridgewater and James Watt. He was one of the first to experiment in the propulsion of vessels by steam, and he built the first practicable steamer in 1807. In the meantime he had also devoted his attention to submarine boats and torpedoes. He exhibited one of the former at Brest in 1801, and subsequently in England, and some of the latter were used against British vessels in the war of 1812, but without much success. Fulton, who had returned to New York in 1806, designed, and, in 1814, began to build the first war steamer. He died in 1815.

Fumaric Acid is an "unsaturated" organic acid of composition $C_4H_4(CO_2H)_2$, which is produced together with another acid of similar composition, *maleic acid*, by distilling *malic acid*. It occurs in many plants and fungi and may be prepared by a variety of synthetic reactions. It forms a white crystalline powder almost insoluble in cold water, but dissolves on warming. If heated it sublimes at 200° and yields the 'anhydride' of the isomeric acid—maleic. The isomerism of these two is remarkable, as their composition appears as expressed by ordinary formulas to be identical, and its existence is best explained by supposing it to be due to a difference in the spatial arrangement of the atoms of the molecule, thus:—



These considerations, due to Wislicenus, have been latterly very successfully applied to other cases of otherwise unexplained isomerism, and have been fruitful in their results. [ISOMERISM. FORMULE.]

Fumigation, the disinfecting of rooms, etc., by means of vapours supposed to destroy infectious germs. The burning of sulphur, incense, camphor, etc., is used for this purpose, but these methods

have little, if any, real use for purposes of disinfection.

Fuming Acids. Fuming sulphuric acid, or Nordhausen sulphuric, is a concentrated sulphuric acid containing some anhydride, SO_3 , dissolved in it. It is obtained as a thick, oily, colourless or brownish liquid of specific gravity 1.88, by heating green vitriol (ferrous sulphate, $\text{FeSO}_4 + 7\text{OH}_2$). When exposed to air it evolves dense white fumes of the anhydride, which immediately forms sulphuric acid with the atmospheric moisture. *Fuming nitric acid* is a very highly corrosive liquid, consisting of concentrated nitric acid, HNO_3 , containing dissolved in it a large proportion of the lower oxides of nitrogen. It may be formed by treating nitre with fuming sulphuric acid mixed with a little starch.

Fuming Liquor of Libairus consists of tetrachloride of tin, SnCl_4 , and may be produced by distilling a mixture of corrosive sublimate with tin powder, in the proportions 5 to 1. It then forms a colourless liquid boiling at 120° , forming with a little water a soft solid, *butter of tin*. It is frequently used in dyeing operations.

Fumitory (*Pumaria*), a genus of small herbs, mostly annual, with slender climbing or straggling stems, decompound leaves and racemes of small crimson, pink, or white flowers of remarkable construction. They have two deciduous sepals; four petals, one slightly spurred and the two inner ones cohering at their apex; and stamens, apparently six in number, in two bundles (diadelphous), with one stamen with a two-chambered anther and two lateral ones with one-chambered anthers in each bundle. The fruit is an achene. These plants are common weeds of cultivated ground in Asia, Europe, North Africa, and now in the United States. The origin of its name *fumus terre*, "the smoke of the earth," is uncertain, but may be from its smoky glaucous foliage. Once valued as a medicine, it is not now used. As "rank fumitory" and "fumiter," it is twice mentioned by Shakespeare.

Funchal, the capital of Madeira, is a seaport at the head of a large bay on the south coast. From the sea, its white houses, backed by steep mountains and rich verdure, wear a most picturesque appearance. In itself the town is neither well-built nor clean, though some improvements have been made to suit the habits of English visitors. On the Loo Rock in the roadstead stands an old castle, and another, that of St. John, is situated above the town, which is protected by several coast batteries. The cathedral possesses no great interest. As a harbour Funchal is far from safe; but it does a considerable trade in wine, fruits, vegetables, and preserves. [MADEIRA.]

Functions, in *Mathematics*, are quantities whose magnitudes depend on the magnitudes of other quantities. The surface of a sphere depends on its radius; hence it is said that the surface is a function of the radius. The connection is given by a simple type of algebraic equation, $s = 4\pi r^2$; where s is the surface required, π is the ratio of circumference to diameter of any circle (a.v.), and r is the given radius. The

connection here shown between s and r being purely algebraical, the function is termed *algebraical*. Again, the cosine of an angle is a function of the angle itself; this is a simple case of *trigonometrical* functions. The logarithm (*q.v.*) of a number is a function of that number; this is *logarithmic*. In fact, there are functions of various types, and dependent on all kinds of variable quantities. To take one case of a complex function depending on more than one variable, the temperature of a point in a cubical block of metal, raised to a white heat and then allowed to cool in air, will be a function of the distances of the point from the faces of the cube, of the original temperature conditions of the block when first it began to cool, of the temperature of the air surrounding the block, and of the time which has elapsed since the experiment began. Numerous problems in physics introduce functions such as this, and demand very refined mathematical skill for their complete solution.

Fundy, THE BAY OF, an inlet of the Atlantic, running up 180 miles between Nova Scotia, S.E., and Maine and New Brunswick, N.W. It has a breadth of 35 miles, and, though deep, is dangerous to navigate. At its mouth lie the Grand Manan and Long Islands, with several outlying rocks, and at its head are Chignecto Bay and Mines Basin. The rivers St. John and St. Croix flow into it from the N. Tides run to the abnormal height of 70 feet.

Fünen, or FÜHNEN (Dan. *Fyen*, anc. *Fiania*), the second in size of the Danish islands, is separated from Zealand to the E. by the Great Belt, and from Jutland to the W. by the Little Belt. It has an area of 1,286 square miles, and an undulating surface rising into hills towards the W. and S.W. The soil is fertile, though the climate is very damp. Corn, flax, hemp, and fruit are grown, and dairy products, as well as cattle and meat, are exported. The coast has numerous small harbours, and many lakes exist inland. The chief river is the Odensee; the chief towns, Odensee, Svendborg, and Nyeborg, are all on the coast. The latter, being opposite Korsør, is the terminus of the railway route from Germany to Copenhagen.

Funeral Rites depend for their significance upon a belief in the continuity of life beyond the grave. The oldest funeral rite is, in all probability, that of sacrifice. Human victims, horses, and other domestic animals were slain at the burial-place that they might accompany the dead to the land of spirits, and there render him services similar to those they had performed for him on the earth. Classic literature abounds with accounts of such sacrifices, which survived in the rite of *Suttee*, where the Hindoo widow threw herself on the burning pyre of her dead husband. The trooper's horse led at the funeral is a survival from the time when the horse was slain at the tomb of its master. An instance where the steed was shot and buried on the coffin occurred at Trèves in 1781; and Longfellow's *Burial of the Minneka* made English readers acquainted with the existence of this rite among the Red Indians. Arms, implements, and domestic utensils were often buried

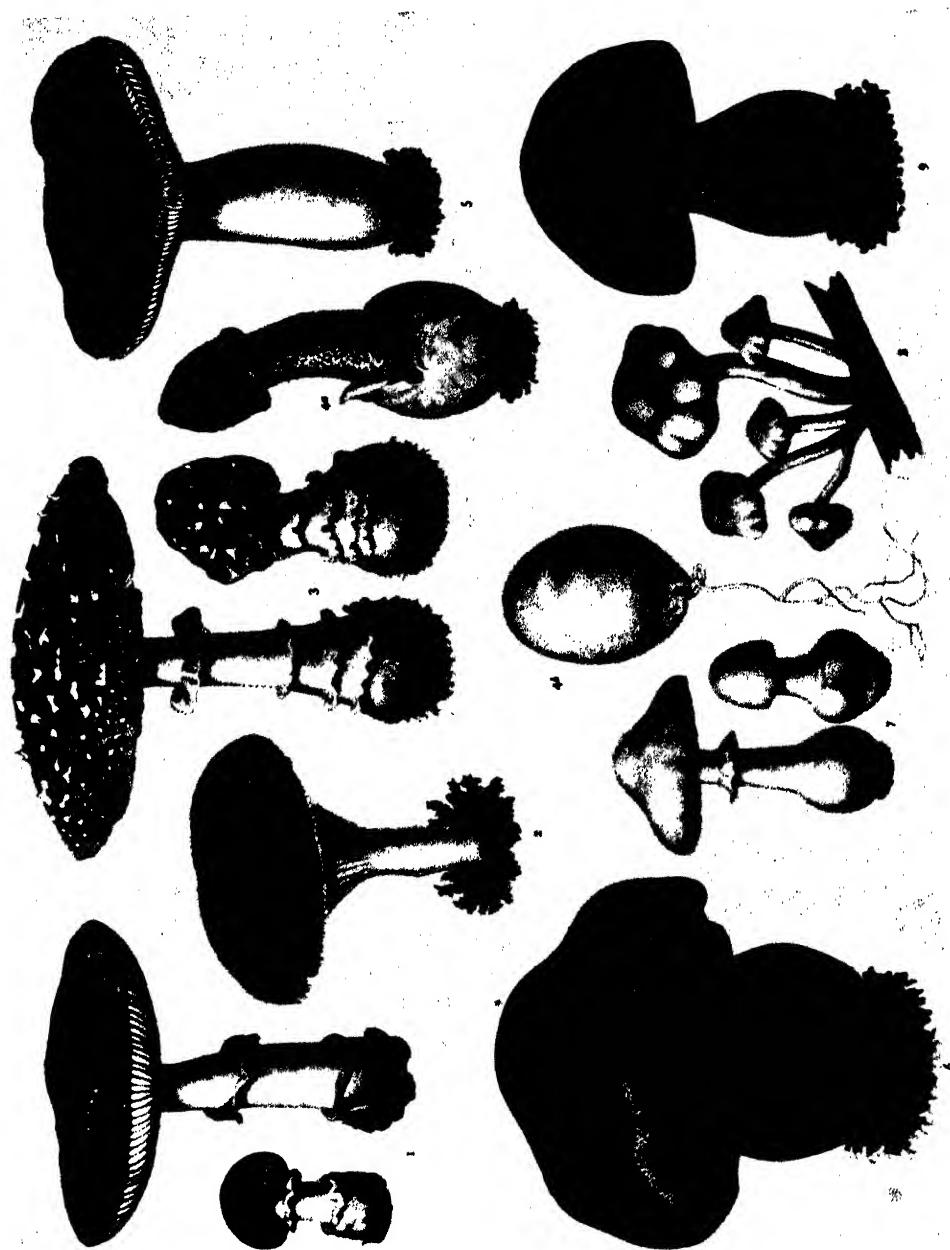
with the dead, and have been found time after time when barrows have been opened. Ezekiel (xxxii. 27) knew the practice as existing among surrounding nations, though it was not common among the Semites. The custom of the Greeks, who put into the hand of the dead an obolus wherewith to pay the ghostly ferryman, is kept up by the German and Irish peasantry, who deposit a coin in the coffin. It is probable that the casting of earth upon the coffin is a survival from the days of cairn-burial, when every relative and friend added his stone to the heap. The distinctly Christian rites consist of religious services, which vary somewhat in different Churches. The passing-bell is no longer believed to drive away demons lying in wait for the parting soul, and the practice of watching by the corpse has degenerated into the wake, now rapidly becoming obsolete.

Fünfkirchen ("Five Churches," Hung. *Pecs*) is a royal free town, the capital of the Baranya circle of Hungary, and stands between the Drave and the Danube, 105 m. S.W. of Pesth. The surrounding slopes of the Mecseg mountains furnish the most productive vineyards of the country, and also possess mines of coal and iron. The bishop's palace in the Italian style, the ancient cathedral, and several of the churches are of high architectural merit, and there are also schools, colleges, and manufactories of woollen and silk fabrics. Alleged to have been founded by the Romans, the town was occupied by the Turks for 150 years, and finally taken by Austria in 1686.

Fung (FÜNJ), an historical Negroid people of the Upper Nile basin, whose original seat was in the Abyssinian uplands south of Senaar and along the middle course of the White Nile. In the first half of the 16th century they entered on a career of conquest, and, after overrunning the surrounding plains, founded the kingdom of Senaar, and gradually reduced all the populations along the Nile valley as far north as Wady Halfa, near the Egyptian frontier. Their empire lasted for three centuries down to the year 1821, when it was overthrown and annexed to Egypt by Ismail Pasha in command of an expedition despatched by Mehemet Ali. The Fungs still form the great bulk of the population, and are divided into several branches, such as the Fung-Berán, the Fung-Hammég, the Fung-Gumuz, the Jebelavins ("Highlanders"), the Taklavina ("People of Takla"), the Shillukas, Bertás, and Dinkas of the White Nile, all of whom claim kinship with this renowned race of conquerors. The Fung language has much in common with the Beja of Lower Nubia [BEJA], and the Fungs themselves appear to have been originally akin to the Agao and other Hamitic aborigines of the Abyssinian plateau; but, through long contact with the Sudanese blacks, they have become largely assimilated in appearance to the Negro type. The nose, however, is straight, hair crisp but not woolly, while the colour varies from a deep, yellowish brown to a deep, bluish black, with very shiny skin, like that of the Nubians. (James Bruce, *Travels*; Trémaux, *Le*

POISONOUS FUNGI.

1. PANTHERINE MUSHROOM (*Cantharellus satanas*). 2. GRAPING MILK AGARIC (*Lepiota clypeolaria*). 3. FLY AGARIC (*Amanita muscaria*).
4. STINKHORN (*Cyathus stercoreus*). 5. BURSTED MILK-ROOM (*Lepiota clypeolaria*). 6. SATANICAL BOLETE (*B. satanas*).



Soudan ; Hartmann, *Skizze der Landschaft Sennar*, in *Zeitschrift für Allgemeine Erdkunde*, vol. xiv.)

Fungi, one of the two main divisions or classes of cellular Cryptogamia (q.v.) or Thallophyta (q.v.), distinguished by the absence of chlorophyll (q.v.). The physiological consequences of this absence include the absence of starch and the possession by every member of the class of a mode of life either parasitic or saprophytic. As parasites they may attack either other plants of any grade, or animals. One important group, the lichens (q.v.), live in a state of symbiosis (q.v.) with some of the lower algae (q.v.). Other fungi live as *entophytes* within the tissues of other living plants. The varied members of the order Schizomycetes, often known generally as Bacteria (q.v.), play an important part in many fermentations and putrefactions and in the aetiology of disease. They are the simplest and most minute members of the class, being single cells, sometimes not more than $\frac{1}{500}$ of an inch in diameter. This order is now by some botanists separated from the Fungi into a class by itself, as are also the Myxomycetes (q.v.), which are not made up of cells at all. All other fungi are made up of *hyphae*, elongated cells or chains of cells, occurring either singly, adhering in parallel lines, or densely interwoven. In some cases pressure gives these hyphae a polyhedral "pseudo-parenchymatous" structure. [PARENCHYMA.] The cell-walls of fungi consist of a modified form of cellulose known as *fungal cellulose*, which does not turn blue with iodine. They are generally unthickened. In many fungal cells no nucleus has as yet been detected; but, though no chlorophyll occurs, metallic greens, reds, violets, and various other colouring matters often occur in the group. Many fungi are undoubtedly poisonous, containing *muscarine* and other poisonous principles, some of which seem to be volatile or to be destroyed by heat. Many other kinds are not only edible but valuable articles of food, though very few species, such as mushrooms, champignons, chantrelles, and truffles, are commonly eaten.

Reproduction is effected among fungi both by sexual and by asexual means, of which there are many variations. The most common non-sexual method is by the formation of special cells or *spores*, either by "acrogenous abjunction" i.e. separation from the extremities of hyphal cells, or endogenously by "free-cell formation" in *sporangia*, such as *asci*; the spores formed being sometimes ciliated *zoospores*, though less commonly so than among Algae. The modes of sexual reproduction also vary considerably in the different families. In several groups there is a marked alternation of generations (q.v.). It is usually possible—at least in the higher groups—to distinguish between a vegetative part of the thallus known as the *mycelium* and a reproductive part known as the *receptacle*. The mycelium is generally a loose mass of filamentous hyphae, sometimes branching or anastomosing. In parasitic forms its hyphae may have short branches or *haustoria* penetrating the cells of the host. In other cases the mycelium forms thick strands formerly known as *Rhizomorpha*, or still more

dense tuber-like masses serving as a resting store of reserve material and called *sclerotia*. Some of these dense mycelia, termed *mycorhiza*, are associated with the roots of various trees, which do not then develop root-hairs, and the association is believed to be a form of symbiosis or commensalism (q.v.).

The receptacle generally rises erect from the mycelium, and may consist either of single hyphae bearing terminal spores, or of relatively large "compound" bodies composed of many hyphae bearing sporiferous surfaces or *hymenia*. The stalk and umbrella-like cap (*pilus*) of the mushroom and the ball-shaped *peridium* of the puff-balls are such compound receptacles. If the hymenium is external, the receptacle is *gymnoperous*; if internal, *angiocarpous*.

The main divisions of the class may be arranged as follows:—

Sub-class i. *Myzomyctes*.

" ii. *Schizomycetes* (Bacteria).

" iii. *Phycomyctes*.

Division 1.—Zygomycetes, including the orders Mucorini (the moulds), and Ustilagineae (the smuts).

" 2.—Oomycetes, including the orders Peronosporae, such as the potato-fungus, and Sapromycete, such as the salmon-disease.

" iv. Ascomyctes, including the orders Pyrenomycetes, such as ergot, and Discomyctes, such as Peziza.

" v. Ascidiomycetes, such as wheat-rust (Puccinia or Uredo).

" vi. Basidiomycetes, including the orders Hymenomycetes, such as mushrooms, and Gasteromycetes, such as puff-balls.

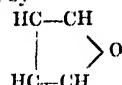
Most of these groups are separately described. The Lichens (q.v.) are forms belonging mostly to the Pyrenomycetes and Discomyctes, but also in some cases to the Hymenomycetes or to the Gasteromycetes, which are associated symbiotically with some of the lower Algae, thus forming compound organisms.

Fungidae, a family of corals including all those in which the septa are united by the small cross bars known as *synaptychia*. The typical genus, *Fungia*, has a form somewhat like the top of a mushroom,

Fung-Whang, the Chinese phoenix, described as adorned with every colour, and combining in its forms and motions whatever is elegant and graceful. Its disposition is so benevolent that it will not peck or injure living insects, or tread on growing herbs. It has not been seen since the days of Confucius. (Williams, *Middle Kingdom*.)

Fünj. [FUNG.]

Furfuran, a compound of composition C_4H_6O , which may be obtained by various synthetical reactions, and occurs in the products of distillation of pine wood. It is a liquid boiling at $32^\circ C$. Its constitution appears to be that of a closed chain, as represented by



and it is interesting as forming one of the compounds which may be regarded as intermediate

in character between the fatty and aromatic series. It yields numerous derivatives, the furfuran compounds, some of which form valuable dyestuffs.

Furlong (A.S. *furlang*, the length of a *furh* or furrow), a measure of length, 220 yards or one-eighth of a mile. The furlong was originally a square measure also; according to Kemble, 200 yards in length and 5 yards in breadth in Saxon times, answering to the *quarentena*, rood, or "small acre."

Furnace, a structure designed to contain burning fuel, and to utilise the heat of combustion to the best possible advantage. For many years the most important furnaces have been those required for steam boilers; and, as the functions of these are various, there have been many kinds of steam furnaces. It must be understood that the design and construction of furnaces with a view to the greatest economy of heat of combustion must be carried out so that complete combustion may be insured before the hot gases pass away from the boiler; a sufficient supply of oxygen must be given to the combustible substances; this supply must be properly mixed with the various heated gases that come off, and the amount of heating surface must be as great as possible. These points apply to some extent to the general design of boilers (q.v.), and need not be discussed here; but, so far as combustion is concerned, it may be stated that the furnace is generally improved by the addition of a combustion chamber for the proper mixing of the combustible gases and the oxygen, though it is not necessary that complete burning should take place therein. Greater efficiency is obtained with forced draught than with natural chimney draught, whose efficiency is frequently 25 per cent. less. In the case of the ordinary Cornish or single-flue boiler, the furnace forms a portion of the front end of the flue, being separated from the rest by a bridge of fire-brick or hollow metal. Similarly in two-flue or multitubular boilers the furnace occupies a portion of the front end of the boiler, and from it pass the various flues. Marine boilers are generally more compact, and economy of fuel, though a matter of great importance, is subservient to economy of space; and whereas land boilers will burn 14 lbs. of coal per square foot of grate per hour, the marine furnaces frequently rise to 24 lbs. But locomotives, with their forced draught and much less heat efficiency, sometimes burn as much as 200 lbs. per square foot per hour. In furnaces employed for smelting, etc., the part of the furnace upon which the charge of ore, flux, etc., is placed, and upon which the metal collects until it is drawn off, is known as the bed of the furnace, and is generally constructed of very refractory fireclay. *Reverberatory* furnaces are a form with low, arching roofs, from which the flames and products of combustion are reflected on to the surface of the ores, etc. *Cupellation* furnaces are, as their name indicates, employed for cupellation (q.v.); a small form heated by gas is of service and much employed for laboratory and assaying purposes. Small gas *muffle* furnaces are also useful for heating

crucibles, etc. In most furnaces the draught is created by the heated gases themselves; but in many, where high temperatures are required, the draught is increased and combustion quickened by blasts of hot air or steam. Large blast furnaces are employed for the smelting of iron ores. [BLAST FURNACE, IRON, SMELTING.] Furnaces in which the highest obtainable temperatures are required, as those for the working of platinum, are constructed of blocks of lime, and heated by the oxy hydrogen blowpipe.

Furness, a manorial liberty comprising the promontory between the mouth of the Duddon and Morecambe Bay, in N.W. Lancashire. It was granted by King Stephen to the monks of Furness Abbey, the ruins of which, dating from 1128, still exist close to Dalton station. The district, though agriculturally poor, has great mineral resources, which have been very successfully developed by the present proprietors, the Dukes of Devonshire and Buccleuch. [BARROW-IN-FURNESS.]

Furnivall, FREDERICK JAMES, M.A., PH.D., was born at Egham, Surrey, in 1825, and educated at University College, London, and Trinity Hall, Cambridge. A barrister by profession, he has devoted his life to English philology and literature, which he has cultivated, not merely by the aid of various special societies, but by a considerable amount of laborious individual research. Dr. Furnivall's chief works are *L'histoire du Saint-Graal*, with its English reproductions, *A Six-Text Print of Chaucer's Canterbury Tales*, *Caxton's Book of Curtesye*, *Robert of Brunne's Chronyel*, and *The Bibliography of Robert Browning*. For several years he acted as editor of the Philological Society's new *English Dictionary*. In 1885 he received a Civil List pension, and of late years he has been engaged in somewhat controversial discussions on Shelley. Dr. Furnivall died, at the advanced age of 85, in 1910.

Furs, the name given to the skins of animals, which have a double coating of hair, that next the skin being short and downy, while the outer coating consists of longer and coarser hairs, intermingled with the former. Fur increases in thickness, and consequently in value, during the winter, and it tends to become thinner as animals grow older. The increased demand for furs in recent times has given a great stimulus to the trade, which is even more prosperous now than it was in the early days of North American colonisation. It seems possible that, unless precautions be taken, the larger kinds of fur-bearing animals, such as the bear and the beaver, may become extinct, or at least extremely rare. Some of the smaller species, on the contrary, thrive better, and increase more rapidly in the neighbourhood of man than they do in a wilder state. Many of the most important fur-bearing animals are natives of Siberia and the northern districts of North America—the expeditions in pursuit of them being undertaken in the spring, when the fur is in the best condition. The smaller kinds abound in the United States, and martens, foxes, hares, and rabbits are common in Europe. Rabbit

NAWA SALAR JUNG BAHADUR,

EDIBLE FUNGI.

1. CHANTERELLE (*Cantharellus cibarius*).
2. MILK AGARIC (*Lactarius deliciosus*)—a. FULL-BROWN; b. IMMATURE.
3. TRUFFLE (*Tuber cibarium*).
4. MUSHROOM (*Agaricus campestris*)—a. FULL-BROWN; b. IMMATURE.
5. HONEY MUSHROOM (*Amanita mellea*).
6. YELLOW CLEAVARIA.
7. MOREL (*Morchella esculenta*).
8. SCALY MUSHROOM (*Agaricus squamosus*).
9. EDIBLE BOLETE (*Bovista edulis*).
10. SPINE-BEARING MUSHROOM (*Hericium coralloides*).



skins are also obtained from Australia as well as those of kangaroos and opossums, while Africa furnishes monkey and leopard skins, and South America chinchillas and nutrias. Skins are seldom dressed before exportation. The first step in the process is to immerse them for some time in liquor; the superfluous fat is then removed by means of a sharp knife, and allowed to dry off; they are next placed in tubs containing butter and warm sawdust, and trodden under foot till the pelt becomes supple, after which dry sawdust is used before they are beaten out. The principal fur-trading companies at the present time are the Hudson Bay Company, established in 1680, and the Alaska Commercial Company, established in 1870. Public auctions for the sale of their furs, including private collections consigned to their care, are held in London in January and March. Continental and Asiatic furs are sold at annual fairs at Leipzig, Nijni-Novgorod, Irbit, and other centres.

It is impossible to give a minute description of all the various kinds of fur, but the following demand particular notice. Among bear skins that of the brown bear is the most valuable, but the coat of the ordinary black bear, which has a long, thick, glossy fur, sometimes fetches £14. They are obtained chiefly from Canada and Alaska. Other varieties are the White Polar, the Russian, and the grizzly bear, which inhabits North America. The under fur of the *bearer* (as well as those of the nutria, rabbit, and other animals) is used for felted materials, after it has been separated from the pelt and the long upper hairs have been removed. It is usually of a rich brown hue, but the best furs are perfectly black. About 150,000 are imported annually from North America. The "real" *chinchilla* fur, as distinct from the "bastard" variety, is much prized for its softness and delicacy. It is bluish grey in colour. The most valuable are imported from Peru. The *ermine* abounds in all northern regions, but is known under that name only in its winter coat of white with a black tip to the tail; in its summer coat it is called stot. Ermee furs are far more valuable than stot furs. Only those found in very cold climates, especially in Siberia, form an article of commerce. *Miniver* consists of ermine with lambskin intermixed in black spots with the material. The most important fox furs are those of the red, cross, and silver foxes, which are all natives of North America, and sometimes form part of the same litter. The ordinary colour of the red fox is sandy red, but it varies from a very pale tint in Minnesota to a brilliant red colour in Kamschatka; the Asiatic variety is often called the "fiery" fox. Those found in Europe are of an inferior quality. This fur is much worn by the Turks, Chinese, and other Eastern nations. The silver fox, found chiefly in Alaska and the Hudson Bay Territory, is scarcer than the red; its colour is silvery grey or black and occasionally perfectly black, in which case the price sometimes reaches £55. The most valuable kind of lamb skin is the Persian, about 200,000 of which are imported annually from Persia. The fur is originally black, but the same colour is used in dyeing it, so as to conceal the white leather below.

The fur of the *marten* has long been esteemed for its softness, lightness, durability, and comparative cheapness; the average price at present is about 25s. It is obtained in large quantities in North America, especially in Labrador, Maine, and the neighbouring districts. The ordinary colour is a rich brown. From the bushy tails muffs and similar articles are manufactured. *Nutria* fur is obtained from the coypu rat, a native of South America. The *sea otter*, found on the Aleutian Islands and elsewhere in the Sea of Kamtschatka, has much decreased of late years in consequence of the recklessness of traders. The price of a skin usually ranges from £20 to £70, but as much as £155 has been obtained. The hair is rich, soft, and glossy. This skin is much worn in Russia. The *otter* inhabits most parts of the world, but the skins sold come chiefly from North America, especially Nova Scotia and Labrador. The fur is remarkably thick and close, varying in colour from light to very dark brown. The outer coating of hair is sometimes retained. The price ranges from 9s. to about £5. The *rabbit* is the commonest of all fur-bearing animals. An enormous number of skins—said to amount to over 10,000,000 annually—is exported from Australia. They are used in a great variety of forms, and "coney wool," the name given to the fur when it has been removed from the pelt, is employed for felting purposes. *Fur seals* formerly abounded in the south seas, but the supply is now drawn from the North Pacific and Behring Sea. The number of Alaska seals caught annually is limited by the United States Government to 100,000. They are for the most part prepared in London. The first step is the "blubbering" or removal of the superabundant fat; this is followed by washing, unhauling, leathering, and dyeing, after which the pelt is shaved, and the "water" hairs are completely removed by machining.

Fûrs (Fors), a large Soudanese nation formerly dominant in the region between Kordofan and Wadai, which from them takes the name of Dar Fûr ("Land of the Fûrs"). They occupy all the Marrah or central uplands (Dar-Dima and Dar-Uma), the chief divisions being the *Dudunga Kunjara* and the royal tribe, *Kera*, whose last king, Barâhûn, was conquered and slain by the notorious Zebehr Pasha in 1873. The Massahâts, another branch, detached some centuries ago from the main stock, are widely dispersed throughout Dar-Fûr and Kordofan, mostly intermingled with the Soudanese Arabs, whose language they now speak. The Furang-bélé, or Fur language proper, has been shown to be related to the Nuba of Kordofan, and there can be no doubt that the Fûrs, Nubas, and Nubiens of the Middle Nile are all members of the same Negro race which at one time was dominant throughout the whole of East (Egyptian) Soudan. The Fûrs of the Marrah mountains are certainly pure negroes, and the women especially are described as of an extremely repulsive type. All are distinguished by their almost black complexion, low, retreating brow, broad, flat features, pronounced prognathism, and short, woolly hair. The moral qualities also are

of a low order, and Nachtigal speaks of them as vainglorious, insolent, lazy, treacherous, and unfriendly to strangers. (Nachtigal, *Dar-Fur, die neue ägyptische Provinz*, in Petermann, 1875; Dr. Pfund, *Reisebriefe aus Kordofan und Dar-Fur*, 1875-76.)

Fürst, JULIUS, was born of Jewish parents at Zerkowo, Posen, in 1805. Destined for the rabbinical career, he acquired a sound knowledge of Hebrew, and went to the University of Berlin. Poverty compelled him to interrupt his studies until 1827, when he broke loose from Jewish orthodoxy and betook himself first to Breslau and then to Halle. At the latter place he enjoyed the teaching of Gesenius, Wegscheider, and Tholuck. In 1839, having begun the publication of his *Lehrgebäude der Aramäischen Idiome*, he obtained a professorship at Leipzig, where he remained until his death in 1873. Among the many erudite works which he produced may be mentioned a *Hebreo and Chaldee Dictionary, Concordantia*, an edition of Buxtorf's great compilation, Histories of the Karaites, and of Biblical literature, and *Bibliotheca Judaica*. He also edited *Der Orient*, a Jewish periodical.

Fürth, a town in the circle of Middle Franconia, Bavaria, at the confluence of the rivers Pegnitz and Regnitz, and 5 miles by rail from Nuremberg. Here Gustavus Adolphus, in 1632, made an unsuccessful attack on Wallenstein, and two years later the place was destroyed by the Croats. The population consists largely of Jews, who are engaged in the making of glass, mirrors, turnery, surgical instruments, lacquer, pencils, etc. A large annual fair is held at Michaelmas. It was ceded to Bavaria in 1806, and its commercial prosperity dates back about 150 years.

Furze, GORSE, or WHIN, the popular names of the small genus *Ulex*, belonging to the order Leguminosæ. They are much-branched, very spiny plants, with axillary, sweet-scented, yellow flowers, which have a bilabiate calyx, and with swollen, few-seeded pods, which burst elastically when ripe. They occur on heaths on a clay or sandy soil, or even on shingle, from Denmark to Italy, and the larger species, *U. europeus*, often forms a characteristic feature in English landscape. A double-flowered form is grown in gardens. The tough woody stem is used for making walking-sticks; and the shoots, if the plant is cut down, when bruised, form a fodder of which cattle are fond. The plant contains a powerfully purgative alkaloid, known as *ulvaine*.

Fusano, LAKE, a small crateric lake in Southern Italy, 16 miles west of Naples, and included in the peninsula of Baiae. It was celebrated for oysters among the Romans, and its picturesque shores served us a favourite burial-place. Hence it was sometimes spoken of as *Acheron* and *Acherusia Palus*.

Fuse, in artillery, a device to regulate the moment of bursting of a shell or explosive charge. Fuses are either "time" or "percussion," or combinations of the two. Time fuses are tubes filled

with a composition which burns at a known speed. They are inserted into the explosive charge, and fired either by hand or, in the case of a shell, by the flash caused by the discharge of the gun. These fuses are generally marked externally, so that they can be set to burn for any desired number of seconds, or fractions of a second. Percussion fuses are fired by the concussion of the impact of the projectiles to which they are fitted, and they can be made to explode the charge either directly or by delayed action. Detonation may also be made to ignite the supply of explosive, in the case of shells. An electric fuse may be used and worked from a distant position if the explosive mass is stationary. A current of electricity is sent through a fine wire which is in contact with the charge, along wires leading from the operator. He can time the current at will, and, if sufficiently strong, it will bring the thin wire to white-heat and produce instant explosion.

Fuseli, or FÜSSLI, HENRY, the son of an artist of note, was born at Zürich in 1741, and brought up for the Church. He took orders, but, having joined with his gifted schoolfellow, Lavater, in exposing a magistrate, had to seek voluntary exile. He reached England in 1763, made the acquaintance of Sir Joshua Reynolds, and by his advice devoted himself to art. In 1770 he went to Italy, where he spent eight years, and Italianised his name. On his return to England he found a patron in Boydell, the organiser of the Shakespeare gallery, brought out a translation of Lavater's *Physiognomy*, assisted Cowper with his *Homer*, and exhibited a series of paintings illustrative of Milton's poems. In 1790 he was elected R.A., and in 1799 was appointed Professor in Painting in the Academy, to which office he afterwards added the keepership. His lectures were published after his death, but they are not of much value, for his slap-dash method could hardly be inculcated by words. He had considerable ingenuity and power, being able to inspire his figures with a suggestion of movement; but he cared little for nature, and derived his ideas chiefly from a morbid imagination. So it came to be a legend that he supped on underdone pork chops in order to court hideous dreams. Of his 200 pictures the most famous, undoubtedly, is *The Nightmare* (1781). His keen sense of humour is shown in his illustrations of the *Midsummer Night's Dream*. He died at Putney, in 1825.

Fusel Oil, known also by the name of potato oil, grain oil, etc., is obtained in small quantities during the alcoholic fermentation of saccharine substances. It consists chiefly of a mixture of different alcohols, but contains also a small proportion of various acids and ethers. The relative proportions of these different substances vary with the nature of the saccharine material employed, with the ferment used, and with the physical conditions of the fermentation. The compounds present in greatest proportions, however, are usually two alcohols known as *amyl alcohol*, $C_6H_{12}O$. One of these is further distinguished as *inactive amyl alcohol*, as it has no action on polarised light. This compound is a liquid boiling at 131.5° C.

specific gravity .8104, and possessing the constitution $(\text{CH}_3)_2\text{CH}.\text{CH}_2.\text{CH}_2\text{OH}$. The second, or *active* amyl alcohol, boils at 127° , is levorotatory [POLARISATION], and has the constitution $\text{CH}_3(\text{C}_2\text{H}_5):\text{CH}.\text{CH}_2\text{OH}$. Fusel oil is soluble in ether, alcohol, and other organic solvents. It is used for the manufacture of *amyl* compounds, and as a solvent for the alkaloids. Its estimation in alcoholic liquors is frequently of importance, and many special methods are employed, but in all cases the determination is one of considerable difficulty.

Fusible Metal is an alloy of 8 parts bismuth, 4 parts tin, and 4 parts lead. It melts at 94° C. , i.e. a temperature lower than the boiling-point of water. By the addition of a little cadmium a product (Wood's alloy) is obtained which melts at a still lower temperature—about 63° C.

Fusion means the change of state of a substance from solid to liquid. It is the reversed half-cycle of changes that take place when a liquid freezes. [LIQUEFACTION.]

Fustian, a twilled cotton fabric, closely resembling velvet. It has a short nap, produced by cutting the loops formed on the surface by the west threads, and afterwards brushing and singeing them. Velveteen and corduroy are varieties of fustian. It is said to take its name from El-Fustat, a suburb of Cairo.

Fustic. Two dyes are known by the name of fustic:—(1) *Young Fustic* and (2) *Old Fustic*. The former of these yields but fugitive colours, and at the present time is not much used. The latter is, however, largely used in woollen and silk dyeing. With a "tin or stannous mordant" it gives a bright yellow, while by use of bichromate of potash, copper sulphate, etc., old gold, olive, and other shades may be obtained. It does not find much application, however, in the dyeing of cotton fabrics. Old Fustic is the yellow wood of *Maclura tinctoria*, a large tree belonging to the Mulberry family, native to the West Indies and tropical America. Great Britain imports less than a thousand tons annually, either as chips, ground, or as extract. The smaller but equally yellow-wooded branches of the entirely distinct *Rhus Cotinus* of South Europe, which is known as the Zante or Venetian sumach, or, from the feathery branches of its inflorescence, as the wig-tree, are similarly employed under the name Young Fustic, being once supposed to be twigs of Maclura.

Fusulina, an extinct genus of Foraminifera (q.v.), very abundant in the Carboniferous period; flat sheets of limestone of this age are formed largely of its shells.

Fyzabad, or FAIZABAD, a division, district, and city of Oudh, British India, under the government of the North-West Provinces. The former comprises the districts of Fyzabad, Gonda, and Bharaih, and has an area of 7,671 square miles. The district of Fyzabad, lying between the Gogra and Gumi rivers, has an area of 1,649 square miles, and contains the ancient city of Ajodhya. It is

traversed by the Oudh and Rohilkund Railway, and has a growing trade and population. The largest towns are Fyzabad, Tanda, Ajodhya, Jatalpur, and Sajauli. Rice, wheat, oilseeds, sugar, cotton, opium, indigo, and tobacco are the chief products. The chief town, Fyzabad, stands on the southern bank of the Gogra, close to Ajodhya, of which it is historically a suburb. It was founded about 1730 by the Nawab-Vizier Saadat Ali Khan. When Lucknow became the capital of the state (1775) it declined, but its prosperity has since increased. At the time of the Mutiny the garrison of Fyzabad let the Europeans escape, but most of them were massacred before reaching Dinapur. The city contains some handsome tombs, and gardens noted for fruit.

G.

G. The letter G is of Italic origin, and was produced by a differentiation of C, to denote the original sound of that letter, as distinct from its other value of k. Of the two sounds of g, the hard and the soft, the former is the original one, which belonged to it in Latin, and persists, even before e and i (cf. *get*, *give*) in words of Anglo-Saxon origin, excepting before e final (cf. *cringe*). The name "guttural mute" is incorrect, since the throat plays no part in the formation of the sound. It was introduced into Latin about the sixth century A.D., and in English is chiefly confined to words of Romance origin.

Gabbro, a name originally applied to an Italian serpentine containing that variety of augite known as diallage; but now used for a family of plutonic rocks of basic composition and granitoid texture, consisting of anorthite or some allied basic felspar with some ferro-magnesian silicate, such as diallage, augite, or less typically hornblende or olivine. Though essentially holocrystalline, these rocks may be coarse or fine-grained: they have a specific gravity between 2.9 and 3.0; and contain from 48 to 54.6 per cent. of silica, from 10 to 29 per cent. of alumina, from 4.8 to 15.8 of iron-oxides, and from 9 to 18 per cent. of lime and magnesia. They occur in the Lizard district, Anglesey, Mull, Skye, Sutherland, Carlingford, etc., forming intrusive bosses.

Gabelentz, HANS CONON VON DER (1807-1874), a German linguist and ethnologist, was born at Altenburg, where too he was educated under the celebrated Greek scholar, Matthiae, and gave his attention especially to Arabic and Chinese. He then proceeded to Leipzig and Göttingen. In 1830 he entered the public service of the Duchy of Altenburg, and in 1848 was member of the Frankfort Parliament, becoming in the same year President of the Altenburg Ministry. From 1851-68 he was President of the Second Chamber, retiring in the latter year to devote himself entirely to study. It was in 1832 that he published his *Elements of Manchourian Grammar*, and in 1843-46 he joined

with an old school-fellow in the translation of Ulfilas's Gothic Bible. He made researches into and wrote upon many Eastern tongues, from Suaheli to Formosan, and in 1860 he wrote a treatise upon the *Passive in Universal Grammar*. His great work (1873) was a treatise upon the Melanesian and Malay group of languages.

Gabelsberger, FRANZ (1789-1849), born at Munich, was the inventor of a system of shorthand much used in Germany and German-speaking countries. He was a secretary in the Bavarian Civil Service, and invented his system for his own private use, and then used it in Parliamentary reporting. His method was to use, as far as possible, symbols closely approaching German forms of letters. He published an account and description of his system.

Gabion, in fortification, a basket of twigs or osiers, in the form of a cylinder, from 2 feet 9 inches to 6 feet high, and about 2 feet in diameter. They are filled with earth and placed in rows as a protection against the enemy's fire.

Gable, the upper part of the wall at the end of a building, which is triangular in form, owing to the slope of the roof. The Gothic gable corresponds to the Classical pediment (q.v.). Gables vary much in their pitch and in the treatment of the outline. In Norman churches the only ornament used was a cross at the apex, but in succeeding styles, the coping, previously flat and plain, is often richly moulded. In the Perpendicular style, however, the sides of gables sometimes consist of a series of steps.

Gaboon River, the Portuguese name of an estuary and settlement on the E. coast of Africa. It has different native names, and is situated just N. of the equator, in lat. 21° 23' N., and long. 90° 21' W. At the entry it is 18 miles wide, and at 40 miles distant it has a breadth of 2 or 3 miles, and takes the name of Rio Olambo, being formed by the tributaries Mkomo and Mbokwa. The former of these is the longer, and has been explored for a considerable distance. Captain Burton explored the second to a point where it narrowed to a width of 50 yards. The south bank of the estuary is low and marshy, and on the north bank, which is higher, is the French settlement of Libreville, which, since the Franco-German war, had, till lately, become merely a coaling-station; but the recent expeditions of De Brazza have re-aroused the attention of the French nation to this region. There are also several English trading-ports, and most part of the commerce has been carried on by the British. The Rembos and the Eko are also tributaries, and there are islands, reefs, and shoals, the chief islands being King's Isle, at the mouth of the Eko, and Parrot Island, in mid channel. It was in 1839 that France first gained a footing in the region, and they gave the name of *Gabons* to the Mpongwa, whom they found to be the principal race there. Other races are the Fans, the Bakalai, and the Boulous. Burton found the Mpongwa to be far advanced in civilisation, and their women to occupy a good position, while their language is the

lingua franca of the colony. The Fans, who also were civilised, but to a smaller degree than the Mpongwa, and who were addicted to cannibalism—only as a religious ceremony, however—have been lately moving forward, and may become the predominant native race. The district exports ivory, bees-wax, caoutchouc, ebony, and canwood, and was once the seat of an active slave-trade.

Gaboriau, EMILE (1835-1873), an eminent French novelist, was born at Saujon. In his early literary career he wrote for the Parisian papers, and his first great success was *L'Affaire Lerouge*, which appeared as a *feuilleton* of *Le Pays*. His tales are of the police and detective type, and display great ingenuity of plot. Two of his works, *L'Argent des Autres*, and *La Degringolade*, were published posthumously.

Gabriel (Hebrew, *man of God*) is generally represented as one of the four archangels, and is especially considered as the messenger of God—*e.g.* to Daniel and to the Virgin Mary. The later Jewish tradition considered him to preside over the forces and processes of nature, and looked on him as the destroyer of the host of Sennacherib.

Gad. 1. The son of Jacob and Leah, and founder of the tribe bearing his name, who were shepherds and also great warriors.

2. A prophet or seer—probably a pupil of Samuel—friend of David, whom he joined in the evil days of his fortune, and whose prosperity he also shared, receiving at Court the name of “the king's seer.” He organised the musical services and wrote a chronicle of David.

Gadames, the chief town of an oasis in the Sahara, in the government of Tripoli, and near Algeria. The oasis is surrounded by an old wall of 10 to 12 feet in height, and the streets of the town are crooked and narrow, and in many cases covered on account of the heat. There are several mosques and schools, and education is general. The oasis is a great meeting centre for caravans, and the inhabitants are good traders and merchants, and have many establishments in North and Central Africa. They are mostly Berber in race, though in the S. there is some negro admixture. There are warm springs in the oasis, and there are remains of Roman architecture.

Gaddi, the name of an Italian family of painters, the chief being—

1. **GADDO** (1239—*cir.* 1312), who painted and did mosaic work, that in the portico of the basilica of Santa Maria Maggiore in Rome being his, and possibly the great mosaic in the portico of the cathedral at Florence. He also executed a mosaic for the old church of St. Peter's at Rome. None of his paintings are known to exist.

2. **TADDEO** (first half of 14th century), son of the above, was a painter, mosaic-worker, and architect, and was the pupil of Giotto. He did frescoes for the church of Santa Croce, Florence, and there are two altar-pieces, a triptych, and other paintings of his.

3. **AGNOLO**, son of Taddeo (latter half of 14th

century), was a painter and also a successful merchant. He painted the *Raising of Lazarus* and eight frescoes in Santa Croce representing the *Legend of the Cross*.

Gade, NIELS WILLEM, a Danish composer, was born (1815) at Copenhagen. In 1841 he published *Echoes of Ossian*. He studied at Leipzig, and succeeded Mendelssohn as leader of concerts. In 1868 he became master of the Chapel Royal at Copenhagen. He published eight symphonies, *Comata*, the *Erl King's Daughter*, and other vocal and instrumental pieces. He died in 1891.

Gad Flies, a family known as the *Tabanidae*, belonging to the order Diptera or true flies; the females of this family are parasites, and live on the blood of various mammals; to obtain this they pierce the skin of the animal with a tubular proboscis and then suck the blood. The bite is painful, but more serious damage than this local irritation is caused by the spread of diseases which result from their attacks; thus the cattle disease known as anthrax is believed to be largely spread by the distribution of the bacillus (*Bacillus anthracis*) by gad flies. The largest English species is *Tabanus bovinus*.

Gadidae (Cod-fishes), a family of Anacanthinous fishes, with twenty-one genera from Arctic and temperate seas. The body is elongated, and covered with small smooth scales; dorsal fin generally divided; ventral fins on the under side of the throat. They are very important food fishes. [BURRET, COD, HADDOCK, HAKE, LING, WHITING.]

Gadolinite, a rare mineral, which was discovered by Gadolin, in 1788, at Ytterby in Sweden. It forms monoclinic crystals, and is interesting as the source of many of the rarer chemical elements, viz.:—*Yttrium*, which it contains to the extent of 35 per cent., *Ytterbium*, *Scandium*, frequently, also, *Erbium*, *Cerium*, *Didymium*, and *Lanthanum*; while sometimes *Beryllium* is found among its constituents.

Gadsden, (1) CHRISTOPHER (1724–1805), was born at Charleston in South Carolina, United States, and, after being educated in England, became a merchant in Philadelphia. He was a member (1774) of the first Congress, and during the war became brigadier-general and lieutenant-governor of South Carolina, and was for a time prisoner in the hands of the British. (2) JAMES, grandson of the above (1788–1858), was born at Charleston, and served in the war against the British in 1812 and against the Indians. His name was given to a portion of territory which, under a treaty negotiated by him, the Government bought in what are now Arizona and New Mexico.

Gaduns (JADUNS), an Afghán tribe, occupying the southern slopes of the Mahaban mountains and parts of the Hazara district within the British frontier of Peshawar. Though long settled amongst the Jusafzaes, they are said to have been originally a branch of the Kakars. Two main divisions: *Salár*, with three septs—Matkhwa, Uta, Sulimán;

Mansúr, also three septs—Khadir, Daolat, Músa. Total population (estimated), 12,000.

Gadwall (*Anas strepera*), a wild duck resembling the mallard, but of smaller size. It is widely distributed in Europe, Asia, and America, but is a very rare British visitor. Large flocks, however, are protected on many Norfolk estates, notably at Merton.

Gaea, or **GAIA**, the Greek goddess of the earth, was, according to one myth, the first-born of Chaos, and mother of Uranus and Pontus, and of the Titans, the Cyclopes, and others. Her story represents a theory of the creation. At Rome she was worshipped as Tellus, and black ewe lambs were sacrificed to her.

Gaeta (anciently **GAIETA**) a coast town of S. Italy, in the province of Caserta, 50 miles N. of Naples, is situated on a promontory jutting into the Mediterranean, and is strongly fortified, and has been called the Gibraltar of Italy. Its bay, which has been spoken of by Virgil, almost rivals the far-famed Bay of Naples. The town has been often besieged, and became the refuge of Pius IX. in 1848–49, and that of Francis II. of Naples in 1860–61. There are many Roman remains, among them being a round tower, known as Torre d'Orlando, which is thought to be the tomb of Plancus, of consular renown. The Constable of Bourbon, killed in the siege of Rome, is buried in the citadel. There is a cathedral—in which is the body of St. Elmo, and which has a former altar of Bacchus as a font—and many churches and convents. There is considerable fishing, and a coasting-trade in corn, wine, oil, and fruits.

Gætulia, an ancient country of North Africa, of uncertain extent, but stretching probably from Mauretania and Numidia, to the basin of the Niger, and bounded on the W. by the Atlantic Ocean. The inhabitants of the region were considered by Sallust to be one of the aboriginal races, and it is possible that they were what are now Berbers, while the Melano-Gætuli of the south showed the admixture of negro blood that is still visible. They were great reavers of horses. Our knowledge of them is derived chiefly from the Romans, with whom they came first into contact in the Jugurthine War. The name soon came to be synonymous in Rome with "Africa" and "African." They gave the Romans much trouble till they were finally subdued by Lentulus, who took the surname of Gætulicus. The country had some renown in the Middle Ages, and it is thought that the name may still be traced.

Gaff, a kind of boom used to extend the upper edge of the mizen, its foremost edge being furnished with two cheeks to embrace the after-part of the mast. A gaff topsail is a light, three- or four-sided sail on the mizen topmast, its head in the latter case extended by a small yard and its foot extending along the length of the gaff.

Gage, THOMAS (1720–1787), an English general, was the son of the first Viscount Gage. He was

born in England, and entered the army while young. In 1750 he was lieutenant-colonel of the 44th Regiment, in 1761 was major-general and governor of Montreal, and in 1763 became commander of the British forces in America, with the title of governor of Massachusetts. His hesitation in dealing with the Boston rioters gave the colonists encouragement and opportunity, and in 1775 the defeat of a detachment which he had sent to Lexington virtually began the War of Independence. Although he gained the battle of Bunker's Hill, he could not raise the siege of Boston, and he was soon after superseded by General Howe.

Gage, Sir William Hall, naval officer, was youngest son of General the Hon. Thomas Gage, and was born in 1777. He served with Sir John Jervis in the *Victory*, and with Nelson in the *Minerve*, and was present at the battle of Cape St. Vincent. Having been made a commander in 1797, and a post-captain in the same year, he distinguished himself in the command successively of the *Terpsichore*, 32, the *Uranie*, 38, the *Thetis*, 38, and the *Iulus*, 74. He became a rear-admiral in 1821, and was from 1825 to 1830 commander-in-chief in the East Indies, and from 1834 to 1837 commander-in-chief on the Lisbon station. He reached the rank of vice-admiral in 1837, that of admiral in 1846, that of admiral of the fleet in 1862, and died in 1864. From 1842 to 1846 he was a lord of the Admiralty, and from 1848 to 1851 he was port-admiral at Devonport. He was knighted in 1834.

Gagern, Hans Christopher Ernst, Baron von (1766-1852), a German statesman and writer, was born near Worms. He was educated at Leipzig and Göttingen, and entered the service of the Prince of Orange-Nassau. He was ambassador to Paris till a decree of Napoleon made it impossible for him to hold the post longer. He then went to Vienna, and tried to rouse a movement against Napoleon in the Tyrol. He was, after the fall of Napoleon, Prime Minister to the King of the Netherlands (Prince of Orange), and represented him ably at the Congress of Vienna in 1815. From 1816-18 he was the Netherlands ambassador to Germany, and in 1820 he retired upon a pension, but still exerted a good deal of influence upon public affairs.

Gahnite consists of an aluminate of zinc ($ZnAl_3O_4$), which crystallises in the regular system, usually in octahedra, resembling the spinels (q.v.). It varies in colour from green to blue-black or brown; has a specific gravity of 7·8, and hardness 4·5. It frequently contains, besides its chief constituents, iron or manganese and sometimes magnesium. It occurs in a few localities in Sweden, Bavaria, and America, but not very plentifully.

Gaikas (Ama-Ngoika), a branch of the Ama-Xosa Kafirs, being descended through Ngqika (ob. 1828) and Khakhabe from Palo (ob. 1780), tenth in descent from Xosa, reputed founder of the famous Ama-Xosa Confederacy, about the year 1500. In 1817, Lord Charles Somerset, Governor

of Cape Colony, recognised Ngqika as paramount chief of the Confederacy, thus setting aside the legitimate claim of Hinza, who, as grandson of Galeka, elder brother of Khakhabe, represented the senior branch of the House of Xosa. The mistake led to the long series of Kafir wars, which resulted, (1877) in the deposition of the paramount chief, Kreli, and the removal of the few surviving Gaikas to the Transkei District between the Kei and Bashi rivers. The Gaikas are now nearly extinct, but the name survives in the *Gaikas Kop*, a mountain nearly 7,000 feet high, between the Kat river and the Amatola range.

Gainsborough, a market town and port of North Lincolnshire, on the right bank of the Trent, 21 miles above its junction with the Humber, and 16 miles N.W. of Lincoln. It consists principally of one long street parallel to the Trent, which is crossed by a stone bridge of three arches. Vessels of 200 tons can reach the town. The parish church has been rebuilt, but retains its 12th century tower. There is in the town an oak timber-framed hall with a tower 78 feet high, and forming three sides of a triangle, which is said to have been built by John of Gaunt. Part of it is now used as a corn exchange and assembly-rooms. The grammar school dates from 1589. Other public buildings are the town-hall and the court-house. Ship-building, malting, and brewing are carried on, and there are iron and brass foundries, and linseed cake and tobacco factories. Pop. (1901), 17,660.

Gainsborough, Thomas (1727-1788), a noted English painter, was born at Sudbury, in Suffolk. His mother had some taste in painting, and encouraged the boy, who at ten years of age had sketched almost everything about him, and at fifteen went to London to study. His energies were devoted chiefly to portrait-painting, but landscape came in for its share of attention. Having married a young woman with a little money, he settled down for a time in Suffolk, and often painted landscapes on the Orwell. In 1759 he went to Bath with his wife and daughters, and there he painted many portraits, among his sitters being Sterne, Richardson, Quin, Henderson, and Garrick. In 1774 he was in London and prospering, and exhibited portraits and landscapes. He was called to Court, and enjoyed both Court and popular favour. Among his sitters at this period were Burke, Clive, and Sir William Blackstone. As a landscapist he was a forerunner of Constable. Among his notable portraits are that of the *Duchess of Devonshire*, and that of *Mrs. Siddons*, the latter known to most visitors to the National Gallery, London, which contains several others of his works also, among the landscapes being *A Waggon and Horses Passing a Brook*.

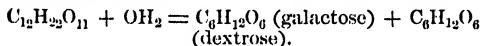
Gairdner, James, born in 1828 at Edinburgh, entered young as a clerk in the Public Record Office, London. In 1859 he became assistant-keeper, and has edited many historical documents, as well as written upon the *Houses of Lancaster and York*, the *Life and Reign of Richard III.*, *Studies in English History*, and a work on *Henry VII.*

Gairdner, Sir William Tennant (1824-1907), elder brother of James, a noted physician, M.D. and F.R.C.P. Edin., and LL.D. Edin., was appointed in 1862 Regius Professor of Medicine in Glasgow University. In 1888 he presided over a meeting of the Medical Association held there. He published several medical books, and contributed valuable papers to medical journals. Among his special subjects have been the lungs, bronchitis, insanity, and hygiene.

Gaius, a Roman lawyer of the 2nd century A.D., of whom next to nothing is known except his work, not even his family name. A decree of Valentinian declared him one of the five lawyers whose opinions were to have weight. His known works are the *Institutes*, *Commentary on the Twelve Tables*, the *Edicts of Magistrates*, and a work on the *Lex Papia Poppaea*. He was probably a practitioner of the conservative school, and much of his *Institutes* was incorporated in Justinian's *Institutes*, in much the same way that Blackstone's *Commentary* has been utilised by later writers. In 1816 Niebuhr discovered a palimpsest of his MSS. at Verona, and this has proved of great value for the light it throws upon antique procedure, and upon the way in which variation of the "formulae" constituted a kind of equitable system.

Galactonic Acid. [GALACTOSE.]

Galactose, a sugar containing six atoms of carbon in the molecule, having the composition $C_6H_{12}O_6$, i.e. a hexose. It originally received the name *lactose*, but this is now applied to a totally different compound, milk sugar, from which *galactose* itself, together with the isomeric *dextrose*, may be prepared by boiling for some hours with a dilute acid. The lactose then breaks up according to the following equation:—



It is seen that it has the same composition as dextrose, which it further resembles in its action on polarised light, being dextro-rotatory [POLARISATION], in fermenting under the influence of yeast, and in reducing Fehling's solution (q.v.). It forms small prismatic crystals, which melt at 166° , and which are soluble in water, though not as readily as dextrose. It yields by oxidation two acids—(1) *galactonic acid*, $C_6H_{12}O_7$, and (2) *mucic acid*, $C_6H_{10}O_8$, while by reduction it gives rise to a body of the nature of an alcohol, *dulcitol*, $C_6H_{14}O_6$ (q.v.). It is estimated quantitatively in the same manner as dextrose. [See also DEXTROSE, LACTOSE, SUGARS, CARBOHYDRATES.]

Galago, a genus of African Lemurs, with 14 species, often distributed into sub-genera, ranging from Senegal and Fernando Po across the continent to Zanzibar and southwards to Natal. The name is also applied to any individual of the genus. They are arboreal nocturnal animals, clothed in soft woolly fur, with bushy tails longer than the body, and large naked ears, feeding on fruit, insects, and small birds and mammals. The hind limbs are longer and stronger than the fore limbs; and there

are nails on all the digits except on the second toe, which is armed with a claw. The largest, *G. crassicaudatus*, is about the size of a cat, and the smallest, *G. muriinus*, said to be gregarious, is no larger than a rat. [LEMUR.]

Galahad, Sir, a knight of the Round Table, who, according to the latest form of the legend of the Holy Grail (q.v.), was, on account of his chastity, the one knight destined to succeed in the quest.

Galangal, formerly written GALINGALE, is an aromatic stimulant drug, apparently introduced into Europe, by Arabian physicians, from China, its name being derived from Kauliang-kiang, "ginger from Kauliang" (Kauchawfu), in Canton. The ordinary galangal of European commerce is the dried rhizome of *Alpinia officinarum*, a member of the ginger family, native to Hainan and probably also to Southern China. The rhizomes are cylindrical, forked, $\frac{1}{2}$ inch or less in diameter, fibrous, striated, and reddish-brown externally with ring-shaped, transverse scars of leaf-scales. It has a pungent odour and a taste resembling Grains of Paradise. Though no longer used in English medicine, galangal is largely employed in Russia in veterinary medicine and cordials. Greater or Java galangal, distinguished by its larger size, orange-brown colour, and feebler odour, though mentioned by Marco Polo, is now rarely imported. It is the rhizome of *A. Galanga*. Galanga cardamoms, used in China, are believed to be the capsules of this species. The preserved ginger from Siam and China is the rhizome of an *Alpinia*. China exports, mainly from Shanghai to India, about 600 tons of galangal annually. The tubers of species of *Cyperus* were formerly used as a substitute for this drug, and Gerard calls *C. longus* "English galingle."

Galapagos, an archipelago consisting of five large and ten small islands in the Pacific Ocean, on the Equator, 500 miles from Ecuador, of which they form part, and to which the three inhabited isles—Albemarle, Charles, and Chatham—formed a penal settlement. They were discovered by the Spaniards in the 16th century, and obtained their name from the multitude of gigantic tortoises, of which the islands contain many species. The islands are of undoubtedly volcanic origin, as is shown by the great number of craters existing, and by the depth of the sea all round. There is little rain, and much of the soil is rocky and parched. The fauna and flora are extremely interesting on account of the isolation of the position, and the fact that many species are peculiar to particular islands. Darwin and Wallace have both made interesting studies in this direction.

Galashiels, parliamentary borough and manufacturing town on the banks of the Gala, a mile above its junction with the Tweed, partly in Roxburghshire and partly in Selkirkshire, 33 miles S. of Edinburgh. It is an ancient place, and was the seat of the Douglases in the 15th century. Wool had been worked here for long, and in 1790 a new impetus was given by the establishment of the first

factory. But whereas £1,000 represented the output in 1790, this had risen in 1890 to £1,250,000. Formerly, shawls and tartans were manufactured there, but now it confines itself chiefly to the goods known as tweeds. There are between 20 and 30 woollen factories, and there is a large skinnery. Galashiels unites with Hawick and Selkirk to send one member to Parliament.

Galata, the name of the business quarter of Constantinople, situated on the N. side of the Golden Horn.

Galatea, the lover of Acis, who was crushed under a rock by Polyphemus the Cyclops, through jealousy. The story has formed the subject of a cantata. The name was also borne by the statue whom Love, at Pygmalion's request, warmed into life.

Galatia, an ancient district of Asia Minor, separated on the N. by the range of Olympus from Bithynia and Paphlagonia; and having on the E. Pontus, on the W. Phrygia, and on the S. Cappadocia and Lycania. It is watered by the Halys—which flows through in a northerly direction—and its tributaries. According to Strabo, it was inhabited by three Gallic tribes who had an elaborate system of government and administration. It afterwards became Hellenised, but long preserved its language and other distinguishing features, including the *patria potestas* (Gal. iv. 1). The country is an elevated plateau from 2,000 to 3,000 feet in height, being most level in the S., where it slopes down into the salt desert. The rest is down-land, and feeds many sheep and goats. There is little wood, and in the northern valleys and hills there are great extremes of heat and cold. The people are said to have originated from Gauls who separated from Brennus during his inroads.

Galatians, EPISTLE TO THE. St. Paul's epistle is believed to have been addressed not to the inhabitants of the whole Roman province of Galatia, but to the descendants of the Keltic colony who lived in the district properly so called. [GALATIA.] It is evident from the epistle that the Galatian churches were founded by St. Paul himself, most probably during his visit to Galatia in his second missionary journey (about 52 A.D.), mentioned in Acts xvi. 6. The passage which mentions a second visit, three years later, implies that at that time there were already many disciples. The epistle was probably written soon after 55, and certainly not later than 59 A.D. Its object was to confute the teaching of a "Judaising" section, who maintained the necessity of Jewish observances. In opposition to their views it emphasises the doctrine of justification by faith.

Galatz, a town and port of Roumania, in the principality of Moldavia, on the left bank of the Danube (here 2,000 feet wide), between the mouths of the Pruth and Sereth, 85 miles from the Sulina mouth of the Danube, and 130 miles N.E. of Bucharest. The town is on a plateau, and consists of the Old Town, a badly-built, unwholesome, ill-drained part, liable to floods, and the New Town, in somewhat better condition, on the rising ground

to the N.W. St. Mary's church contains the tomb of Mazeppa. The International Commission, appointed under the terms of the Treaty of Paris, 1856, for the navigation of the Danube, has its seat here, and Roumania has a representative. Ships of 150 tons can come up to Galatz, and there are flour-mills, saw-mills, cooperage works, and much exportation of grain.

Galaxy, or MILKY WAY, is a luminous belt of stars, nearly surrounding the heavens in a complete circle. It is in one thick band for about two-thirds of its length, but for the remainder it is divided into two parallel strips. It intersects the ecliptic near the solstices at about an angle of 60°. It is composed almost entirely of small stars of the eighth and higher magnitudes. In it are a great number of star clusters, but not many true nebulæ. Certain parts are so thick with stars that they cannot be counted. The two Herschels made careful estimates of the number of stars in various parts of the galaxy and of other regions of the heavens, but by reason of unfounded assumptions concerning the size and distance of the stars they arrived at incorrect conclusions as to the structure of the heavens. It is now generally understood that the great mass of stars in our stellar system lie in or near a plane passing through the Milky Way; they are contained, in fact, in a disc-shaped region, whose diameter is about ten times its thickness. They are not arranged with anything like uniform distribution, but in irregular clusters. Our own sun is a member of the system, and occupies a position near the centre of this region. The rest of the heavens on each side of the Milky Way is comparatively starless, but contains a large number of nebulæ. [STARS.]

Galba, SERVIUS SULPICIUS (A.D. 3-69), a Roman Emperor, was a promising youth, and seemed capable of great things. He was consul in 33, and administered several provinces as proconsul. When the hatred of Nero grew too strong, the soldiers sounded Galba as to being emperor, but he hesitated till he knew that Nero had designs on his life. He was not pleasing as emperor to those who had created him, as he would not bribe the soldiers or pamper the populace. Hence his murder.

Galbanum, a balsamic gum-resin, light-brown, yellowish or greenish-yellow, translucent, with a musky smell and an acridly bitter taste. It contains a blue oil identical with that of chamomile. Galbanum is mentioned as a spice in Exodus xxx. 34, and as a medicine by Hippocrates, Pliny, and Avicenna. It is now administered as an anti-spasmodic, expectorant, and stimulant; but is inferior to asafetida. Galbanum is apparently the product of the umbelliferous species, *Ferula galbaniflua* and *F. rubricaulis*, natives of Persia, and of *F. Schair*, native to Turkestan. It is imported in small quantities from Bombay and the Levant.

Galchas, the aboriginal Aryan population of the Central Asiatic highlands, still forming the dominant element in Kohistān, Ferghāna, Roshān, Wakhān, Karateghin, Shignān, and Badakhshān. Although commonly described as "Highland Tajiks,"

the Galchas constitute a distinct primitive group intermediate between the Indian and Iranian Aryans, and should consequently not be confounded with the Iranian Tajiks, from whom they differ as much as these do from the Persians. They belong, not to the dark, but to the fair division of the Caucasian family [CAUCASIC RACE], being of tall stature and light complexion, with brown, hazel, or blue eyes, chestnut, ruddy, or blonde hair, wavy and curly, thick beard, and extremely brachycephalous skull, in this respect closely resembling the primitive Celtic peoples of Savoy, Auvergne, and Brittany. [CELT.] Their chief divisions in Kohistán are the Maghians, Kchtoutes, Falghars, Matchas, Fâns, and Lagnôbs, all of whom speak Aryan dialects more akin to the Iranic than to the Indic branch of the Aryan mother-tongue. That of the lagnôbs appears to be of an extremely archaic type, and its study, scarcely yet begun, is expected to throw much light on the mutual relations and divergencies of the Asiatic members of the Aryan family. With the Central Asiatic Galchas must also be grouped the Siah-Posh Kafirs of Kafiristán and the other primitive peoples of the southern slopes of the Hindu-Kush range, whom they closely resemble in physique and probably also in speech. The Galchas proper of Kohistan, numbering altogether about 33,000, are mainly monogamists and Sunnite Mohammedans, though still preserving many usages and ceremonies, evidently derived from the old Mazdean religion of East Irania. They are occupied chiefly with agriculture, and also possess some cattle, horses, and other live-stock. (G. de Meyendorff, *Voyage à Boukhara*, Paris, 1826; Ch. E. de Ujfalvy, *Expédition . . . en Russie, en Sibérie, et dans le Turkestan*, Paris, 1878-79.)

Galekas (AMA-GCALEKA), a historical Kafir nation, named from a chief, Gealeka, who flourished towards the close of the 18th century, and who was lord paramount of the Anna-Xosa confederacy. [GAIKAS.] The original Galeka territory, which lay between the Kei and Bashi rivers, was annexed to Cape Colony after the last Kafir war of 1877, and now forms, with Bomvaniland, one of the Transkei administrative districts. But the present Galeka-land stretches from the mouth of the Kei to the Umtata, with a total area of 1,350 square miles and population of 65,000 Galekas and 12,000 Bomvanis. Kreli, third in descent from Gealeka, was one of the most renowned of Ama-Xosa warriors, and since his defeat and deposition by the English in 1877, peace has prevailed throughout Kafirland.

Galelas, an enterprising people of North Jilolo, Eastern Archipelago, who belong to the Indonesian division of the Malayo-Polynesian races. "They build large and roomy praus with outriggers, and settle on any coast or island they take a fancy to. They hunt deer and wild pig, drying the meat; they catch turtle and tripang; they cut down the forest, and plant rice or maize, and are altogether remarkably energetic and industrious. They are a very fine people, of light complexion, tall and with Papuan features, coming nearer to the drawings and descriptions of the true Polynesians of Tahiti

and Owyhee than any I have seen" (A. R. Wallace, *The Malay Archipelago*, 5th ed., p. 325). Those, who are classed by the Malays as "Alfuros"—that is to say, non-Mohammedans or Pagans, speak a distinct language, which shows scarcely any resemblance to the Malayan group.

Galen, an ancient medical writer (*circ.* 130-200 A.D.), was born in Mysia. He was trained in the Stoic philosophy, and was proficient in logic, on which he wrote much—only one, however, of his treatises (that on *Certain Fallacies*) being extant. In 146 he began the study of medicine, and went to Smyrna to follow up the subject. In 158 he returned to his native town, Pergamus. In 164 he went to Rome, where he acquired a good practice and a great reputation for learning. In 170 he accompanied Marcus Aurelius to Rome, and was made medical guardian of his son, Commodus, and here he died at 70. He is said to have written as many as 500 treatises. On many medical points he is still an authority.

Galena, lead-sulphide (PbS), by far the most important ore of lead (q.v.), is a lead-grey metallic mineral, tarnishing somewhat on exposure, crystallising in the Cubic system, in cubes or in combinations of the cube and regular octahedron, or occurring massive. Its hardness being 2·5, it will mark paper. Its specific gravity is 7·3 to 7·6. In composition it is about 86·6 per cent. lead and 13·4 sulphur; but there is generally a proportion of silver (q.v.) present. When galena is sufficiently *argentiferous*, the precious metal is extracted by Pattinson's process. Galena occurs in veins, abundantly in clay-slate in Cornwall and Devon, associated with ores of copper and zinc, and in the Carboniferous Limestone of Lanark, Derby, etc., and in various localities in France, Germany, Belgium, and the United States.

Galerites, one of the best known fossils of the Chalk. It is an Echinoid with a conical test, a central mouth, and with the anus also on the under side. They are known to the quarrymen as "fossil sugar loaves."

Galerius, VALERIUS MAXIMUS (d. 317), a Roman Emperor, who was born in Dacia, and served with distinction in the army. In 292 Diocletian gave Galerius his daughter in marriage, and made him Cesar. He defeated the Persians, and when in 305 Diocletian abdicated, Galerius took the eastern half of the Empire, retaining the power till his death, while Constantius ruled in the West. Galerius was a good soldier and commander.

Galibi, a branch of the Carib race, who were formerly very numerous and powerful on the coast-lands of the present French colony of Guiana. Poncot de Bretigny, who led an expedition to that region in 1643, found that all the previous French settlers had either been exterminated or assimilated to the Galibi people. They had forgotten their mother-tongue, and had adopted both the language and usages of the Galibi. Akin to these coast tribes are the Galibios of the Upper Parana basin, Brazil, who are regarded by some authorities as the primitive stock of the Carib race.

Galicia. 1. An Austrian crown-land, having Russia to the N. and E., Hungary S.W., and on the W. Austrian and Russian Silesia. Its area is 30,000 square miles. The Carpathians occupy a third, and most of the rest is a succession of terraces descending to the plain of Russia, with some low land near the Vistula. There are two heights in the Carpathians of 6,000 and 7,000 feet respectively. Its rivers belong partly to the basin of the Baltic, partly to that of the Black Sea, the tributaries of the Vistula being in the former, and the Dniester in the latter. There are a few lakes and many morasses, and several mineral springs. The climate is severe, and much of the land is forest. There is some coal, iron, lignite, zinc, and salt, and Cracow is the seat of the iron manufacture. Corn, hemp, flax, and tobacco are grown, and horses, cattle, and bees are reared, and there is a good deal of transit trade done down the Dniester. The towns of Lemberg and Cracow have each a university. The inhabitants are chiefly Poles and Ruthenians. The Austrians first got a footing in Galicia in 1772, and it was not until 1846 that they finished acquiring it.

2. An ancient kingdom of N.W. Spain, now containing Corunna and three other provinces, is on the Bay of Biscay and the Atlantic, being 125 miles long by 115 broad, and having an area of 11,222 miles. The Pyrenean chain runs through Galicia from E. to W., and two spurs branch off in a S.E. direction, enclosing the basin of the Minho, which is the chief river, and has a course of 170 miles to the Atlantic. The Minho has many tributaries, and there are other rivers, those to the N. having short, turbulent courses. The coast-line of 240 miles has many good harbours, among them being Vigo Bay, the port of Corunna, Vivero Bay, and the Rivadeo. The climate is mild, and there is much rain, rendering the land fertile. Timber, cattle, and pigs—which feed under the oaks and chestnuts—fruits, game, and fish are abundant. Lead, tin, copper, and iron pyrites are found, and there is some manufacture of linen and cotton. The chief exports are cattle, sardines, preserved meat, chestnuts, nuts, and potatoes. Most of the people are engaged in agriculture, and the native Gallego is looked on as a good-natured but thick-headed fellow.

Galignani, JOHN ANTONY (1796-1873) and WILLIAM (1798-1882), two Parisian publishers, were the sons of an Italian who set up an English library in Paris in 1800, and in 1814 founded *Galignani's Messenger*. The sons took his work on, and did much to advance English interests in France.

Galilean Telescope is the simplest form of telescope, invented by Galileo, and employed most usefully by him in his observations on the heavens. It consists simply of two lenses—an *object* or *field-glass* and a concave *eye-piece*. The object-glass would of itself give an inverted image of the object, but the eye-piece is placed so as to prevent the formation of a real image from the field-glass, and the result is that an enlarged *erect* image is obtained. Opera-glasses are constructed on this principle; they have the advantage of showing

objects in their right position, an advantage which is not shared with ordinary telescopes. Possessing only two lenses, it absorbs but little light; but because of the divergence of the waves of light, as they emerge from the concave eye-piece, it is necessary that the eye shall be placed very near the eye-piece. The invention is strictly due to a Dutchman, Jacques Metius, who discovered it by accident in 1609. By its means Galileo discovered the mountains of the moon, Jupiter's satellites, and the spots on the sun. [TELESCOPE.]

Galilee, one of the four Roman divisions of Palestine, is in the N. and extends from the Mediterranean to the Jordan. It is now part of the bashalic of Damascus in Syria. The upper part is generally hilly and well-wooded; the lower, level and fertile, though great irregularities of formation give evidence of volcanic action. The principal inhabitants of old times were Syrians, Arabs, Phoenicians, Greeks, and some Jews, who were much despised by their co-religionists at Jerusalem. The principal towns were Tiberias, Cana, Capernaum, Nazareth, and Nain. Tiberias, after the fall of Jerusalem, became a great seat of Rabbinical learning. The Sea of Galilee is a large lake about 13 miles long and 7 in width, and 820 feet deep, lying at the bottom of a great volcanic basin, and containing clear fresh-water well stocked with fish. To the S. lies the Jordan valley, and the river enters the lake through a narrow gorge.

Galileo (properly GALILEO GALILEI), 1564-1642, a great astronomer, born at Pisa, of an ancient noble family. As a boy he was fond of literature, and of making toy machines. He was educated at the monastery of Vallombrosa, near Florence, and then studied medicine at Pisa university. In 1583 the sight of a lamp swinging in the cathedral at Pisa set him investigating, and shortly after this time he began to study mathematics, and this gave a new direction to his genius. In 1586 he invented a hydrostatical balance, and in 1588 he published a treatise on the centre of gravity in solids. He became a lecturer in the university, and from 1589 to 1591 was occupied in experiments, but offended many by his outspokenness. From 1592 to 1610 he occupied the chair of mathematics at Padua, and gained much reputation. In 1597 he constructed the first thermometer, but his great feat was in so improving the telescope as to be enabled to make many discoveries till then undreamt of. He was formally prohibited by the Pope from teaching the Copernican doctrines, but having ridiculed the accepted or Ptolemaic theories in 1632, was summoned before the Inquisition, perhaps tortured (but this is very doubtful), and sentenced to imprisonment during the Papal pleasure. He was, however, released, and permitted to reside at Florence. He continued his researches, but became blind and died in retirement. For the present Roman Catholic view of his case, see W. G. Ward, *Dublin Review*, 1871.

Galipot, the resin which exudes from incisions of old standing in the maritime pine (*Pinus maritima*) of Bordeaux.

Galitzin, a Russian family of much note, the chief members of which have been:—(1) VASILI (b. 1643), who was the regent during Peter the Great's minority, and who did much to introduce Western influence into Russia. His desire to marry Sophia brought about his downfall. (2) DIMITRI (1735–1803), who was ambassador to Holland, and was a friend of Voltaire. (3) DIMITRI, son of the above (1770–1840), became a Catholic, and was ordained a priest, being known as "Father Smith." He was vicar-general of Philadelphia, and founded the town of Loretto in the Alleghanies. His inheritance was forfeited, owing to his refusal to return to Russia.

Gall, FRANZ JOSEPH (1758–1828), a German physician, born at Tiefenbrünn. In early days he formed a theory that internal qualities corresponded with external conformation, and this led to the development of his system of phrenology, on which, with Spurzheim, he lectured in Germany. His doctrines did not meet with great success, and he went to Paris in 1807, and in 1819 became a French subject. In 1820 he visited London with a view to lecturing, but was disappointingly received. He wrote works on phrenology, some of them being written in conjunction with Spurzheim.

Galland, ANTOINE (1646–1715), a French Orientalist, was born in France. He was employed to catalogue Oriental MSS. for the Sorbonne, and in 1670 was attached to the French Embassy at Constantinople. In 1673 he went to Syria and the Levant, and collected many antiquities. Between 1676 and 1679 he made other journeys to the Levant, and after his return he studied thoroughly Arabic, Turkish, and Persian. In 1704 he made a translation of the *Arabian Nights*, and in 1709 was appointed to the chair of Arabic in the Collège de France.

Galla Ox, an Abyssinian variety of *Bos taurus*, with very long lyrate horns.

Gallas, a people of north-east Africa, who form a main branch of the Ethiopic or Eastern division of the Hamitic race. Their domain comprises the whole of Gallaland, Enarea, and Kaffaland, together with large tracts of Shoa and Gojam (South Abyssinia), and most of the little-known region extending from Kaffaland through the Lake Rudolf (Samburu) depression southwards to the Tana river and eastwards to the Upper Juba basin. The Gallas are thus conterminous on the north and east with the Abyssinians, the Afars, and the kindred So'ali, on the west with the Nilotic Negroes and the remotely-connected Masai, southwards with the Wa-Pokomo and other Bantu peoples of the Tana basin, their territory having a total area of nearly 400,000 square miles, and a population roughly estimated by Krapf at from six to eight millions. Being Hamites, the Gallas belong to the same Caucasie division of mankind as the Europeans [CAUCASIC RACE], and they are physically, perhaps, the finest people in Africa, tall, well-proportioned, with high, broad forehead, aquiline nose, well-cut mouth, oval face, coppery or light chocolate complexion, and black kinky hair usually worn in short

ringlets or "finger curls" round the head. In their mental qualities and natural intelligence they compare favourably with all the surrounding populations, so much so that Galla slaves have always commanded the highest price in the Soudanese markets. Their language, spoken with considerable uniformity throughout the Galla domain, is a distinct member of the Hamitic family, closely related to the neighbouring Somal and intermediate between the western Masai and northern Dankali (Afür). The term *Galla*, although of native origin, meaning "conquerors," is not the national name, their most general designation being *Orma* (*Oromia*), "men, stout, valiant," and more fully *Ilma'orma*, "sons of the brave." Galla, however, already figures on Fra Mauro's map (1459), where the lower course of the Xebe (Juba) is called the *fiume di Galla*. But the earliest reference to the race occurs in the celebrated Greek inscription of the first century found at Adulis (Annesley Bay), where mention is made of the *Arousi* people south of Shoa, near the territory of the present *Arussi*, who are still one of the most powerful branches of the Galla nation. The tribal divisions are past counting, and each tribe comprises two sections, the *prutuma* or herdsmen, and the *kutto* (*argatta*) or tillers of the soil, the former being the superior or aristocratic, the latter the plebeian class. It is evident that originally the *Ilma'orma* were essentially a pastoral people, who at some remote period penetrated most probably from the north-east into their present domain, where they still regard themselves as invaders, *Ilma Galla*, "sons of the conquerors." Here many of their tribes have at various times been brought under Abyssinian and Arab influences, while others have hitherto kept entirely aloof; hence some are still pagans, some Mohammedans, some Christians of the Abyssino-Coptic sect, these latter being collectively called *Sidama* Gallas. Hence also, despite a certain vague sense of a common nationality, the several groups have long been animated by mutual feelings of hostility, intensified by the Mohammedan slave-hunting expeditions. They live in a chronic state of inter-tribal warfare, and many of the *prutuma* class lead a restless nomad existence, raiding the more sedentary *kutto*, and plundering wayfarers and caravans along the trade routes. The national arms are the spear, sword, and shield, and most of the northern tribes fight mounted on small, wiry, and mettlesome horses. The men wear a cotton loin-cloth, saturated with butter, to which the wealthy add drawers and a short skirt, resembling the Scottish kilt. They adorn themselves with ivory armlets, adding one for every enemy killed in battle, while the women are decked with copper or tin bracelets and a profusion of glass beads worn round the neck, their costume consisting of a dressed skin smock and a short tunic. Polygamy is permitted, and the women occupy a degraded position in most of the tribes, in which the communal system forms the basis of the social organisation. All authority is centred in the *prutuma* class, which is grouped in *pakhidahs*, with a council of a hundred elders at their head elected for 16 years. These elders elect in their turn an assembly of 300

members, by whom is chosen the *buku-el-kebir*, or great tribal chief. (Krapf, *Travels, etc.*, London, 1860; Ch. Tatschek, *Grammar and Dictionary of the Galla Language*, Munich, 1844-45; C. Beke, *On the Origin of the Gallas*, in *Report of the British Association*, for 1847; Harris, *The Highlands of Ethiopia*, vol. iii.)

Gallatin, ALBERT (1761-1849), was born and educated at Geneva. In 1780 he went to the United States, and taught French at Harvard. He then acquired property and entered into politics, and in 1801-13 was Secretary to the Treasury, showing great powers of finance. In 1814 he negotiated the peace with England, and from 1815-23 was ambassador to Paris. He wrote on finance, politics, and ethnology, on the Indian tribes, and on the semi-civilisation of Mexico, Yucatan, and Central America; and he was the first president of the Ethnological Society of America.

Gall Bladder. [LIVER.]

Galle, a fortified town in the S.W. of Ceylon (q.v.). It is situated on a low rocky promontory, and has a good harbour in a small bay, which, however, has become of less importance since the construction of a breakwater at Colombo. The town is beautifully provided with trees, and has some interesting old Dutch buildings.

Gallein ($C_{20}H_{10}O_7$) is employed as a dye under the name of *anthracene violet*. It is obtained by heating a mixture of pyrogallic acid and phthalic anhydride. It forms green crystals, which dissolve in alcohol to a red, and in potash to a red or blue, solution, the colour in the latter case becoming blue by addition of excess of potash. It produces colours varying from bluish to red purples. By the action of sulphuric acid it gives rise to *carrulein* (anthracene green), which is also employed in dyeing for the production of various shades of olive-green.

Galleon, anciently, a ship of war of the largest size, with three or four decks of guns; but, in the 18th century, one of the large Spanish merchantmen employed in regular voyages to the Indies and elsewhere, and usually having four decks, and carrying guns. Until after the commencement of the 19th century the galleons sailed yearly from Cadiz, and were away for about two years. The chief ones brought home the produce of the Potosi silver mines, and also much gold, precious stones, wool, quinine, skins, leather, etc. The number of galleons varied, and was greatest in time of war; but a single one with her cargo was often worth nearly two millions sterling.

Gallery, in Elizabethan houses and some of earlier date, was a long narrow apartment, frequently in the upper storey, which served either as a passage or as a place where entertainments could be held. But the word was, and is, commonly used in a sense equivalent to that of "loft"—i.e. a platform or raised stage inside an apartment. Such was the Minstrels' Gallery at the lower end of the great hall in ancient mansions, which was set apart for the musicians. In mediæval churches

there was usually a wooden gallery over the rood-screen (q.v.), between the chancel and the nave. It was called a Rood-loft, because it was surmounted by a large cross or rood. In other parts of the church stone galleries were erected for the accommodation of worshippers. Norman examples remain at the west end of the north transept in Winchester cathedral, but they are less common in England than in France or Germany, where they are commonly found at the west end. The triforium (q.v.) also, which forms part of the original structure, is essentially a gallery. In foreign cathedrals seats are still sometimes placed here for the congregation, and in ancient days it seems to have been used for the actual celebration of service. The wooden galleries now common in churches were introduced after the Reformation.

Galley, a low, flat-built vessel, originally peculiar to the Mediterranean, having one, two, or three masts with lateen sails, a raised and covered poop and forecastle, and a long open waist, in which, upon one or two tiers of benches, sat slaves, chained to the huge sweeps by means of which the craft was mainly propelled. The galley generally carried guns upon the forecastle, and occasionally also on each quarter. The largest gallies, called galeasses, had a total length of as much as 162 feet, and a beam of 32 feet, with 64 oars and about 350 rowers. The galley of a ship is the general kitchen or cook-room. A galley is also a name given to a light pulling boat, such as is reserved to the use of the commanding-officer of a man-of-war.

Gall Flies. A series of insects belonging mostly to the *Cynipidae*, a family of the Hymenoptera (q.v.), though some are members of other orders, such as the *Oecidomyidae*, which belong to the Diptera or true flies. The galls themselves are vegetable, and are pathological growths of the tissues of a plant in the effort to surround some parasitic insect larva, or to heal the wounds it has produced. The best-known English galls are the common "oak-apples," formed on oaks by the *Andricus terminalis*, one of the Hymenoptera. The gall-nuts of commerce, which are of great importance in the arts, as they are used largely in the manufacture of inks and dyes, are similar galls: they are formed by species of the type genus *Cynips*. Another common type of galls occurs on the undersides of leaves; they are usually in the form of small hard discs: the so-called "oak-spangles," due to the larva of *Neuroterus lenticularis*, is a familiar example of this series. A third class of galls occurs as soft, mossy, or bush-like growths, instead of hard nodules or discs: the "bedeguar" of the rose is a familiar type of this group; it is due to the attacks of *Rhodites rosea*. The gall insects present an interesting case of the "alternations of generations" (q.v.), for they are dimorphous. The gall flies are generally winged, but in many cases series of apterous, or wingless generations, intervene between those which are winged. The former are strikingly different in appearance from the latter, as the wings of these are very large in proportion to the body.

Galliard, a spirited dance, in high favour in the 16th and 17th centuries: the same as the Italian *romanecca*. It was confined to two dancers, and out of it was developed the minuet. The music accompanying it had a triple rhythm, and was lively but not rapid.

Gallic Acid has the composition $C_6H_5(OH)_3COOH$, being *trihydroxybenzoic acid*. It occurs in various plants as sumach, tea, dividivi, etc., and in gall-nuts. It is found, also, combined in various tannic acids or tannins, from which it may be obtained. Thus, ordinary tannic acid, if boiled with a dilute acid, breaks up into gallic acid—



It may be prepared in this manner, or by exposure of an infusion of gall-nuts to air, the addition of a little yeast accelerating the formation. It crystallises in fine silky needles, slightly soluble in cold, and readily in hot, water, the solution possessing an astringent, slightly acid taste. If heated, it is converted into *pyrogallol*, the *pyrogallic acid* of the photographer. The reaction is thus expressed—



It acts as a strong reducing agent, precipitating silver from its solutions. It may be recognised by the fine blue-black precipitate it gives with ferric salts, and by the rapid colouring (green, then brown) of alkaline solutions when exposed to air. It is employed for making inks, and, to some extent, medicinally as an astringent.

Gallican Church, a name given to the Roman Catholic Church in France, with special reference to the opposition which it formerly displayed to Papal claims. Christian churches must have been founded in Gaul before the latter part of the 2nd century A.D., for during the persecution under M. Aurelius, many suffered martyrdom at Lyons, including Pothinus, bishop of the town. Irenæus, the successor of Pothinus, had been a disciple of Polycarp, and this fact, together with the constant connection maintained with Smyrna, and the general sympathy with Eastern views, leads to the conclusion that the Church of Gaul was mainly, if not entirely, of Asiatic origin. Like other branches of the Church, it advanced rapidly after the establishment of Christianity under Constantine; but it passed through a severe struggle during the invasion of the barbarian races, most of whom had already adopted the Arian form of Christianity. It was saved from the Arians by Clovis, and both he and his successors saw that a steady union with so strong an organisation was the surest means of maintaining the power of their own dynasty. As the power of the Papacy became established amidst the political and social confusion which followed the death of Charlemagne, the Church in France, as in other countries, sought to extend its own influence and authority by complete submission to the claims of the Roman See. The Pragmatic Sanction of 1269 subordinated the authority of the Pope to the common law of the country as well as the canons of councils, and the same course was pursued more boldly by Philip the

Fair in his struggle with Boniface VIII. The degradation of the Papacy during the "Babylonish Captivity" led to still further limitations of its power. The enactments of general councils took the place of Papal decrees as the source of authority in ecclesiastical matters; by those of Constance and Basel, Church patronage was in great measure transferred from the Pope to the Crown, and the privileges thus gained were confirmed by the Pragmatic Sanction of Bourges (1437). The concordat of 1516 gave the right of instituting bishops to the Pope, while that of nominating them was retained by the Crown; but the French people still looked back to the Pragmatic Sanction and the decrees on which it was based as the most fitting expression of the relations which should exist between Church and State. The movement towards "Gallicism" reached its height in the reign of Louis XIV., who was determined to assert his supremacy in ecclesiastical as well as civil affairs. In his contest with Innocent XI. concerning the Regalia (q.v.), he was supported by the eloquent and influential Bossuet (q.v.), who drew up the famous Declaration of the French clergy in 1682. This Declaration was condemned by several Popes, but the Crown maintained the same attitude up to the time of the Revolution. In 1790 an attempt was made by the "civil constitution of the clergy" to reorganise the Church on a democratic basis. At the same time a violent attack was made on ecclesiastical privileges; the clergy were deprived of their tithes, and the Church lands were confiscated. During the Reign of Terror public worship was suspended, and the Church for a time ceased to exist. By the concordat of Napoleon, then first consul, with Pius VII., in 1801, the Church was re-established and public services were resumed; but most of the changes introduced during the early part of the Revolution were retained. In 1810 Napoleon, now emperor, returned to the Declaration of 1682. In 1817 there was a new concordat, by which that of 1516 was again recognised; but in 1826 a full assembly of bishops expressed their adhesion to the principles of 1682. In 1830 all creeds were placed on the same footing. The course generally followed by the State in ecclesiastical and religious matters since that date has completely alienated the Church, which is now decidedly Ultramontane (q.v.) in its tendencies. The strongest proof of this was given at the Vatican Council of 1870, when the French bishops accepted the doctrine of the infallibility of the Pope.

Gallienus, PUBLIUS LICINIUS (Roman Emperor 260–268 A.D.), was the son of Valerian, who made him his colleague in the government. When his father was imprisoned by the Persians, the son lost all energy, and reigned only in Italy, the rest of the empire being governed by different generals, who earned the name of the Thirty Tyrants. Gallienus was murdered while besieging Milan.

Gallinaceous Birds, the RASORES of some authors, an old order of Birds (q.v.), containing the Game Birds, Sand-grouse, Bush Quails, Mound Birds, Curassows, Tinamous, and in some cases the Pigeons. The Linnaean term *Gallinæ* is now often revived in

this sense, and the Pigeons are generally given ordinal rank.

Gallinule. [MOORHEN.]

Gallio, JULIUS ANNÆUS (1st century), was born at Cordova, and was the brother of Seneca the philosopher. He came to Rome, and was adopted by Gallio, whose name he took. During the reign of Claudius he became proconsul of Achæa, and is said to have been afterwards one of Nero's latest victims.

Gallipoli (1) (ancient *Kallipolis*), is a seaport of Turkey in Europe, at the N.E. extremity of the Dardanelles, on a peninsula, 90 miles S. of Adrianople, and 130 miles S.W. of Constantinople. It is a poor town, but has good bazaars, some mosques, and Roman and Byzantine remains. It is a key of the Dardanelles, and was occupied and strengthened by the English and French in 1854. There is a lighthouse on the cliff. (2) A seaport of South Italy, in the province of Lecce, 25 miles N.E. of that city and 50 miles S. of Brindisi. It is on a rocky isle to the E. of the Gulf of Taranto, and a bridge of 12 arches unites it to the mainland. It has a cathedral, a castle built by Charles III. of Anjou, and huge underground cisterns, hewn in the rock, for storing the olive oil produced in the district. There is a good deal of tunny-fishing.

Gallium, a metallic element of atomic weight 69·8, which was discovered by Boisbaudran in a particular variety of zinc ore in the year 1875. He became aware of its existence by means of spectrum analysis (q.v.), and, although it exists in the ore in only very small quantities (about 1 part in 60,000), he succeeded in obtaining sufficient for examination. It is a bluish-white metal, which melts at 30° C., and when melted may remain so for several weeks, even at much lower temperatures, but instantly solidifies if touched by the solid metal. It is tough, and has the specific gravity of 5·9, is soluble in hydrochloric but not in nitric acid. It is best detected spectroscopically, being recognised by two lines in the violet end of the spectrum. The discovery was rendered more interesting by the fact that the element was found to agree almost completely with the description of a metal whose existence was predicted by Mendeleef in 1870 on the ground of his Periodic Law, and called by him *Eka-aluminium* (q.v.).

Gallocyanines, a number of blue and violet dyes, which are obtained from gallic acid and some of the tannins by the action of certain aniline derivatives—nitrosodimethylauiline. That from gallic acid is the best known, and receives the name *solid violet*. They give blue, violet, or red solutions, according to the solvent employed, frequently exhibiting a fine fluorescence. For dyeing cottons a tin or chromium *mordant* is generally employed, but for the dyeing of silk or wool no mordant is necessary.

Gallofavin, a yellow dyestuff obtained by the oxidation of gallic acid. This is usually accomplished by blowing air through a solution of the acid in dilute potash until a precipitate occurs,

which is afterwards treated with a dilute acid. By recrystallisation it is obtained in yellow crystals, which dye cotton yellow, the shade varying with the mordant employed.

Gallon is the standard of liquid capacity in the United Kingdom. It is a very old measure, one of Henry VII. being of capacity 274 $\frac{1}{4}$ cubic inches, of Queen Elizabeth 282 cubic inches, and of Queen Anne 231 cubic inches. These were abolished in 1824, when the present standard imperial gallon was introduced. It is defined as the capacity of 10 pounds of distilled water weighed in air at a pressure of 30 inches of mercury and a temperature of 62° Fahr. This has a volume of 277·274 cubic inches, and is, therefore, very nearly the same as the old Winchester corn gallon of Henry VII. The quart is the fourth part of the gallon, and is further subdivided into 2 pints.

Gallo-tannic Acid. [TANNIC ACID, TANNIUS.]

Galloway, a district in the S.W. of Scotland, now almost coextensive with Wigtonshire and Kirkcudbright, but formerly much larger. It is 70 miles long by about 40 miles broad, and has long been famous for its breed of small horses and black cattle. The chief occupation, however, now of its inhabitants is dairy-farming, for which its mild and genial climate admirably suit it. The surface is in parts mountainous, and there are many lakes and streams. In the Roman period Agricola is thought to have made a strong settlement here, and the many Roman remains seem to confirm this view. The name is said to be derived from Gall-Gael or foreign Gaels, and, though the natives were subdued by the English in the 7th century, they preserved their language till the 16th century, and many of the local names have a Gaelic appearance.

Galloway, MULL OF, the southernmost point of Scotland, 23 miles S. of Stranraer, at the end of a peninsula called the Rhins of Galloway. The promontory, which is a little more than a mile long and about a quarter of a mile broad, is 210 feet high, and has a lighthouse, whose light is visible 23 miles out to sea, and which commands a view of the Isle of Man, the Irish coast, and the Cumbrian mountains.

Galls. [GALL FLIES.]

Gallus, (1) TREBONIANUS (251–253), a Roman Emperor, who succeeded Decius, and was murdered by his troops. He is remembered for having paid the Goths to leave Rome alone. (2) C. CORNELIUS, a Roman poet, the friend of Virgil and Ovid. He was born 66 B.C., and committed suicide somewhere about 26 B.C. from chagrin at being banished for maladministration in Egypt. Of four books of elegies upon his mistress, *Lycoris*, only fragments are left.

Galt, JOHN (1779–1839), a Scottish novelist and trader, was born at Irvine, in Ayrshire. After a desultory education, he became a clerk at Greenock, but his versatility of character soon took him to London, where he tried his hand at literature, and entered at Lincoln's Inn, and after projecting a

Life of Wolsey, he embarked for the Continent upon an errand connected with the embargo laid upon British commerce by Napoleon. In the course of this voyage he visited Greece, Constantinople, and Asia Minor, and made the acquaintance of Lord Byron. After returning to London, he made another voyage to Gibraltar with a similar object. These voyages he commemorated in *Voyages and Travels* and in *Letters from the Levant*, but these works were not well received. Later in life he made an expedition to Canada, which proved disastrous, and he returned home to die in poor circumstances at Greenock. Of his many works those which have made most impression are *The Annals of the Parish* (1821), *The Provost*, *Sir Andrew G. Wylie*, and *The Entail* (1823).

Galton, FRANCIS, SIR, F.R.S., born at Duddeston in 1822; was admitted at King Edward's School, Birmingham, from which he went to the Birmingham Hospital, and later to King's College, London, to study medicine, finally graduating at King's College, Cambridge, in 1844. In 1846 he went to North Africa, and to South Africa in 1850; has held office in the British Association and other scientific bodies, and was knighted in 1909. Latterly he has given his attention to anthropology and eugenics, and has written upon *Tropical Exploration, Hereditary Genius, Natural Inheritance, Finger Prints*, and many kindred subjects.

Galvani, LUIGI (1737-1798), an Italian physiologist, was born at Bologna, where he became Professor of Anatomy in 1762, and lectured with much success, and gained a reputation in comparative anatomy. In 1791 he wrote his celebrated *Commentary on the Power of Electricity in Muscular Movement*. He was afterwards removed from his post for political reasons, but was subsequently reinstated. In 1840-42 a quarto edition of his works was published by the Academy of Sciences at Bologna, and some manuscripts have recently been discovered. A statue was erected to him at Bologna in 1879.

Galvanised Iron consists of wrought iron, the surface of which is coated with an alloy of zinc and iron. No definite electrical process is undergone to effect the deposition of the zinc, though the name almost implies such a process. The iron is well cleaned and freed from all rust by immersion in dilute acid, and is then dipped into a bath of zinc kept melted under sal-ammoniac (ammonium chloride, NH_4Cl). The advantages gained by galvanising iron are that in this state the metal does not so readily corrode and rust by exposure to the atmosphere and moisture. It is hence much used for manufacture of culinary and kitchen articles, for wire, roofing, and many other purposes, for which ordinary iron, owing to the ease with which it oxidises and rusts, would be unsuitable.

Galvanism is the old name given to the study of current electricity, in honour of Galvani, who was the first to investigate the effects of electric currents. Nevertheless, he formed certain misconceptions as to the cause of the currents produced

in his experiments, and the correct explanations were due to Volta. On this account the term *voltaic electricity* is now much more in use to express the same idea.

Galvanometer is an instrument of much importance in current electricity, designed primarily to measure the strength of electric currents. In the article on **ELECTRICITY** it was explained that the strength of current was proportional to the electromotive force or available pressure in the circuit and inversely proportional to the total resistance of the circuit; that, in fact, the current could be estimated in suitable units by Ohm's law,

$$C = \frac{E}{R}.$$

If E is measured in volts and R in ohms, C would be estimated in this formula in ampères. An instrument that is to determine the magnitude of C may be put in any part of the circuit, because the strength of the current is the same in all parts. Nevertheless, if the instrument measures the current by some means that require the actual passage of the current through the instrument, it is evident that the resistance of the instrument itself must not be such as to seriously alter the total resistance of the circuit, otherwise the introduction of the instrument alters the quantity that we require to measure. Most galvanometers are of this nature; the electric current is made to pass through the instrument, and by reason of certain quantitative laws that regulate the effects of currents, observation of its effects may be interpreted so as to give us the current strength. Now it happens that with all the ordinary types of galvanometer sensitiveness is only obtained at the expense of extra resistance; that is to say, an instrument may be made more sensitive, so as to be capable of measuring smaller currents with accuracy, but only by making its resistance greater. The resistance itself is not desired, but it is a necessary consequence of the greater sensitiveness introduced. It follows, therefore, that the introduction of a sensitive galvanometer into a low-resistance circuit is useless; for the high resistance thus introduced entirely spoils the current to be estimated. It usually happens that the sensitive galvanometer is not required in such cases, for the currents in low-resistance circuits are sufficiently large to be measurable by less sensitive instruments. On the other hand, in the case of a high-resistance circuit containing, let us say, 120,000 ohms resistance, the introduction of a galvanometer of 2,000 ohms resistance brings up the total resistance to 122,000 ohms, which is not so different proportionally to the original state of things. The current is altered but to a very slight extent, and the instrument is likely to be of sufficient sensitiveness to measure the small current existent in this circuit.

The principle of the galvanometer is that of the action of an electric current upon a magnetic or electro-magnetic needle. If a needle be suspended by a fine silk fibre, or supported on a sharp point, it will be drawn into the plane of the magnetic meridian, and will point to the magnetic north and south. If a wire be brought near it through which

an electric current is passing, the needle will tend to arrange itself at right angles to the wire. The tendency is to some extent hidden by the earth's controlling force, which still pulls it in the direction of north and south. There is thus a definite deflection produced, representing the direction of the resultant force acting at each end of the needle; the resultant force is due (1) to the controlling force of the earth's magnetism; (2) to the deflecting force due to the electric current. On the relation between these two forces depends the deflection produced. The deflecting force is increased by placing the wire as near as possible to the needle and by increasing its length. This latter is most conveniently effected by winding it round a bobbin in many coils. The effect produced by 40 coils is approximately equal to 40 times the effect produced by a single coil; but the resistance of the 40 coils is also increased 40 times. It is useless to increase the number of coils indefinitely, because they must occupy space, and after a time they become too distant from the needle to be at all efficient. More coils can be wrapped in the same space by using finer wire, but this also means increasing the resistance of the instrument. Finally the deflecting force may be made to have a maximum effect on the needle by adjusting either the coil or the needle so that the force is at right angles to the needle. With regard to the controlling force, it is desirable that this should be small if the instrument is to be highly sensitive. Using a weaker magnet certainly diminishes the controlling force, but it also diminishes the deflecting force in the same proportion. Hence a weak needle is just as sensitive as a strong one, other things being equal. But if, instead of using a weak magnet, a pair of equally magnetised needles be fixed parallel to each other at about a distance of one inch apart, with opposite poles adjacent, the pair will, as a whole, have a very small controlling force acting on it, but the deflecting force due to the coils will be increased. Such a combination is called an *astatic pair*, and is much used in delicate galvanometers. The controlling force on a needle may also be diminished by the use of a *controlling magnet* that may be fixed on a vertical axis above the instrument, and placed near or remote at pleasure, thus varying the sensibility through a considerable range.

The following are the chief types of galvanometer known to electricians:—

Tangent Galvanometer, in which the deflecting force is arranged always at right-angles to the controlling force, which must be constant in magnitude. The tangent (q.v.) of the actual deflection produced is here a measure of the current strength. The conditions required are obtained by using a large circular coil placed parallel to the magnetic meridian, and by suspending a *small* needle in the centre-line of the coil. Such an instrument is not very sensitive, because of the necessarily great distance of the coil from the needle.

Sine Galvanometer, in which the deflecting force is arranged always at a constant angle to the needle, and in which the controlling force is constant in magnitude and direction. The current is measured

by the sine (q.v.) of the angle of deflection. The instrument is not required to satisfy any further conditions, and all galvanometers may on this account be used on the sine principle. The instrument is most sensitive when the "constant angle" required is a right-angle, but by choosing this angle anything between 90° and 0°, a great range of sensitiveness may be obtained.

Astatic Galvanometer means, as a rule, a fairly high-resistance galvanometer with an astatic needle. A convenient form was designed by Nobili.

Mirror Galvanometer is a sensitive high-resistance galvanometer first devised by Lord Kelvin for cable purposes, intended for the measurement of very small currents. Minute deflections are recorded by fixing a small mirror to the needle or its suspension; this mirror may be made to reflect a beam of light on to a graduated scale, and any small motion of the mirror gives a magnified motion of the spot of light on the scale.

Differential Galvanometer is one in which there are two equal coils wound round the bobbins so as to have the same magnetic effect. Equal and opposite currents flowing through the coils will, therefore, produce no effect on the needle, and the instrument is thus capable of determining the equality of two currents and indirectly the equality of two resistances also.

Ballistic Galvanometer is one that measures the quantity of electricity that is suddenly discharged through the instrument. This is estimated by the magnitude of the first throw of the needle in much the same way as the momentum of a bullet is measured by means of the first swing of the *ballistic pendulum* (q.v.), into which it is projected. [ELECTRICITY.]

Galvanoscope is an instrument for the mere indication of the presence of electric currents. It acts on the same principle as a galvanometer.

Galveston, a seaport and the largest town of Texas, U.S.A., situated on an island in Galveston Bay, about 30 miles long, with an average width of 2½ miles. The bay is about 35 miles in length and 12 to 18 miles broad. There is a good harbour, protected by a sea-wall. Great extensions and improvements have been made since the tidal-wave of 1900 wrought havoc, and a permanent causeway was projected in 1910 to connect with the mainland. As a commercial port, it is now second only to New York. There are a Catholic university and cathedral, many schools, a medical college, and hospitals. The principal export is cotton. Among the industries are foundry and machine-making.

Galway, a maritime county in the west of Ireland, in the province of Connaught, having the Atlantic Ocean on the W., Clare and Galway Bay on the S., Mayo and Roscommon on the N., and Roscommon, King's County, and Tipperary on the E. It is the largest county after Cork, and contains over a million and a half acres. Lough Corrib, which covers 30,000 acres and has many islands, divides the county into an eastern part, which is for the most part level, with much bog, but having

in the N. fertile land and in the S. the Slieve-baughty mountains, and a western part—sometimes called Connemara—which is mountainous and wild. There are many harbours on the coast, used chiefly by fishermen, who with the agricultural population make up the inhabitants. In the west are the mountains of Binabola or the Twelve Pins, which reach 2,400 feet in height. The Shannon is the only large river, others being the Suck, the Claregalway, and the Ballynatrinch. Of the lakes, which west of Lough Corrib are about 130 in number, Lough Rea is noted for its scenery. Other tracts—called “turloughs”—are underwater for part of the year. The county is rich in minerals, and there are mineral springs. Among the antiquities of the county are cromlechs, seven round towers, and many ruins of monastic buildings, including Knockmoy, with its frescoes illustrating ancient Irish costumes. There are also Anglo-Norman remains. Pop. (1901), 192,549. The town of Galway, capital and a county in itself, is on the N. shore of Galway Bay, on the river Corrib, which unites Lough Corrib with the Atlantic. It returns one member. There are some curious old buildings and a notable cruciform church. Brewing, tanning, distilling, and paper-making are carried on, and there is a good salmon fishery. Pop. (1901), 13,414. Galway Bay, between Galway and Clare, has a length of 30 miles and an average width of 10 miles, and its entrance is protected by the three isles of Aran—Inishmore, Inishmaan, and Inisheer.

Gama, VASCO DA (c. 1460–1525), a Portuguese discoverer, was born at a small seaport in the province of Alemtejo. In his youth Prince Henry the Navigator died, and when Manoel succeeded João II. on the throne, Vasco da Gama, who had made himself a name in the wars with Castile, was sent in 1497 with four ships upon a voyage of discovery, one special object being to discover the country of Prester John. With difficulty he rounded the Cape, and then, under the guidance of an Indian pilot, crossed the Indian Ocean, and arrived at Calicut. Owing to the jealousy of traders, he had to fight his way out of harbour, and returned to be ennobled and treated with much favour. In 1502 he was given command of a squadron sent out to avenge some massacred traders, who had been left by Cabral to found a trading colony at Calicut, and on this occasion he bombarded Calicut and committed great acts of cruelty. The king gave him solid proofs of his gratitude, and for a time Da Gama lived in retirement, but in 1525 João III. made him Viceroy of India. He went to Goa, and the same year died at Cochin. He is celebrated in the *Lusiad* of Camoens, and Correa's *Three Voyages of Vasco da Gama* have been translated for the Hakluyt Society.

Gamaliel is a Hebrew name, often met with, but more particularly bestowed upon three noted Rabbis, of whom the first is that Gamaliel at whose feet St. Paul sat. He was noted for his tolerance towards the Christians and other Gentiles. He was thought to have become Christian, but this is improbable. GAMALIEL OF JABNEH was the grandson of the above-mentioned, and after the fall of

Jerusalem was the head of the nation. Both of these were among the seven great Rabbis of the Talmud.

Gambetta, LÉON MICHEL (1838–1882), was the son of a small tradesman at Cahors, and was called to the Paris bar in 1859. He first attracted general notice by his attack on the Empire as counsel for the defence in the Delescluze trial in 1868. In 1869 he became deputy for Marseilles. After the fall of the Empire he was appointed Minister of the Interior, and was in Paris during part of the siege, but escaped in a balloon, and as War Minister and practically Dictator was the heart and soul of the resistance to the Germans. He was bitterly opposed to any armistice. In 1871 he had difficulties with the Government, and retired to Spain, and had no part in the troubles of the Commune. On his return he was elected for several departments, but chose to sit for the Bouches du Rhône. In 1875 he was opposed to M. Thiers, but his views in a measure triumphed in 1875, when a Republican form of Government was decreed. In 1877 his firmness saved the country from a possible civil war on behalf of monarchy, and though condemned to three months' imprisonment for an alleged threat against the President, he was not imprisoned, and MacMahon resigned. Gambetta would not take office, because of the refusal to adopt the *scrutin de liste*, but from 1878–80 he was President of the Chamber, and in 1881–82 he occupied the post of Prime Minister. He resigned, still over the question of the *scrutin de liste*, which the majority would not adopt, and thenceforward kept in the background in politics. He was killed by the accidental discharge of a pistol at Ville d'Avray, near Paris, on Dec. 21, 1882. His speeches have been published, as has also a life.

Gambia, a river of West Africa, rises in a high land 240 miles inland, which contains the sources of the Senegal and some tributaries of the Niger. The mouth of the Gambia is in lat. 13° 50' N. It is thought to have a course of 1,400 miles, and the estuary is 27 miles across in places, though at the mouth only two. It is navigable for steamers for some distance, and for boats to the falls of Barraconda, three hundred miles from the mouth, and for a long distance above the falls. Below Barraconda the country on both sides is liable to be flooded, and the river leaves behind a fertilising deposit. The British colony of Gambia—which is now independent of Sierra Leone, and provides a Houssa force for its own defence—lies mostly on the left bank of the river, and has for its capital Bathurst, which is on St. Mary's Island at the mouth of the river—an island of sand, about 15 miles long, by one broad, and separated from the mainland by a creek and swamp. Opposite the island is British Combo, a territory of six miles by three; and about 200 miles up the river is McCarthy's Island, which contains a trading-town called Georgetown. There is some weaving, and oil and brickmaking; and the chief exports, besides the ground-nut, are hides, cotton, rice, kola-nut, and indiarubber. There is telegraphic communication with Europe, and Liverpool steamers call fortnightly.

Gambier. [CATECHU.]

Gambier, JAMES GAMBIER, first Lord, second son of James Gambier, Lieutenant-Governor of the Bahamas, was born in the Bahamas in 1756, and, as a commander, was captured in the *Thunder*, bomb, by the French in 1778. In the same year he was posted, and as captain of the *Raleigh*, 32, served ashore at the reduction of Charleston in 1780. He commanded the *Defence*, 74, on the Glorious First of June, 1794, and became a rear-admiral in 1795, a vice-admiral in 1799, an admiral in 1805, and Admiral of the Fleet in 1830. He was made Governor of, and commander-in-chief at, Newfoundland in 1802. He effected the seizure of the Danish fleet in 1807, and was for this service created a baron of the United Kingdom; and he was commander-in-chief in the Channel when, in 1809, Lord Cochrane made his splendid attack upon the French ships in Basque Roads. He relinquished this post in 1811. In 1814 he was one of the commissioners appointed to treat at Ghent for peace with the United States. In 1815 he was made a G.C.B., and for many years he had a seat at the Board of Admiralty. He died in 1833.

Gambling, or GAMING, the playing any game of chance, such as cards, dice, etc., for money or money's worth. Gaming houses, together with unlicensed playhouses and disorderly houses, are either at common law or by statute public nuisances, and may upon indictment be suppressed and their keepers fined, and in some cases imprisoned with hard labour. Against gaming-houses in particular assiduous care has been bestowed by the Legislature; and by statutes passed in the reigns of Henry VIII., Anne, and George II., the keeping of common houses for unlawful games and a variety of specified games was prohibited under heavy penalties; and by several statutes of the present reign further provisions have been made regarding the offence now under consideration, and in particular for the punishment of those who keep or frequent *common gaming-houses*, and for suppressing such houses. These statutes provide that the owner or keeper of any common gambling-house, and every person having the care or management thereof, and every banker, croupier, and other person in any manner conducting the business of any such house, shall on conviction by the oath of one witness before two justices of the peace be liable, in addition to penalties prescribed by 33 Henry VIII., c. 9, to pay such penalty, not exceeding £500, as shall be adjudged by such justices or, in their discretion, to be committed to the house of correction, with or without hard labour, for not more than twelve months; but any witness who shall make true discovery to the best of his knowledge shall be entitled to a certificate of his having done so, and shall thereupon be freed from all criminal proceedings, forfeitures, and disabilities for anything he has himself done, and, on the other hand, anyone found in a suspected gaming-house may be required to be examined and to give evidence, and shall not be excused on the ground that such evidence will tend to criminate himself. One of the above statutes provides that anyone who by fraud, unlawful device, or ill-practice shall win

any money or valuable thing shall be deemed guilty of obtaining it by false pretence, and be punished accordingly; also that all contracts, whether verbal or written, by way of gaming or wagering, shall be null and void, and that no action shall be brought to recover any money or valuable thing alleged to be won on any wager or which was deposited with any person to abide the event; but this enactment is not to apply to any subscription towards a plate or prize at any "lawful" game, sport, pastime, or exercise. By 36 and 37 Victoria, c. 38, every person betting in any street, road, highway, or other open and public place was liable to conviction or fine (40s. first offence, £5 subsequently). In the reign of the late King Edward VII., the repressive legislation was continued, the "Act for the Suppression of Betting in Streets," passed in December, 1906, making the fine for the first offence £10, for the second £20, and for further convictions £50, or six months' imprisonment. [LOTTERIES.]

Gamboge, a gum-resin obtained from the bark of *Garcinia Hanburii*, *G. Morella*, and allied species of that genus of the order Guttiferae or Clusiaceæ, trees, with opposite, glossy, leathery leaves, natives of Siam, Cambodia, Cochin China, Ceylon, and Southern India. Gamboge occurs in "pipes" or "rolls" and in lumps. It is of a dirty orange externally, hard, brittle, with a conchoidal fracture, and odourless. It contains 20 to 25 per cent. of gum, with 70 to 75 per cent. of the resin gambogic acid. Britain imports from 10 to 80 tons annually, mainly from Bangkok and Saigon. It is used as a pigment, for colouring varnishes, and as a purgative.

Game and Game Laws. The right or privilege of hunting, taking, and killing certain animals *ferae naturae* in exclusion of other persons has been long recognised in Great Britain, and there formerly existed a system of a severe character under which none were permitted to take or sell game unless duly *qualified* in respect of property, and the ordinary qualification originally was the ownership of lands or tenements in possession or an estate of inheritance of the yearly value of £100 or for life, or 99 years or upwards of the yearly value of £150—a qualification imposed chiefly for the prevention of idleness and dissipation in the lower classes—and with the same view, and also for the benefit of the revenue, it was subsequently made necessary for sportsmen to take out a yearly game certificate attesting the payment by them of a certain duty. The principle of requiring any personal property qualification has long since been abandoned, and statute 1 and 2 William IV., c. 32, has provided that the right to kill game upon any land shall be vested *ratione soli* in the owners of such land (mere occupiers for short terms excepted) or in any person having the grant or permission of such owners for the purpose; but a game certificate is still required, and the above-named statute and the statute 23 and 24 Victoria, c. 90 (the principle Game Acts now in force), require all persons killing, taking, or pursuing game to take out a yearly *excise license*, which is substituted for the former game certificate, and these statutes also require persons who, having no such licence, deal

in game to take out an excise licence for this latter purpose. The revenue from gun-licences, dog-licences, licences to kill game, and certificates to deal in game, has now been granted to the County Councils under the "Local Government Act, 1888." The above statutes also contain many penal provisions intended for the better preservation of game and for the protection of the landowner from *poaching*, whether by night or otherwise, and generally against unlawful trespasses in sporting. Under these acts, game is defined to include hares, pheasants, partridges, grouse, heath or moor game, black game, and bustards, though some parts of the Acts are also directed to deer, woodcocks, snipes, quails, landrails, and rabbits. As to hares, there are also some special provisions, one being that in the absence of special agreement to the contrary, any occupier of enclosed lands or any owner thereof with the right of killing game therein, may kill hares on such land without an excise licence, and that such licence need not in any case be obtained by one who pursues hares with greyhounds, beagles, or other hounds. By the Ground Game Act, the right of the occupier to kill ground game, such as hares and rabbits, concurrently with the landowner or other person entitled under him to such game, is made a right inseparable from his occupation, and he cannot contract himself out of his right under the Act, and the occupier need not take out any licence. The law regulating the pursuit of animals in the chase has made certain distinctions. Thus if one starts any such animal on his own ground, and follows it into another's, and kills it there, the property remains in himself; but if, being a trespasser, he starts it on another's land and kills it there, the property belongs to him in whose ground it is killed and this even though the trespasser may have sold the dead game to a third person. Again, if it be started by a stranger in anyone's chase or free warren and hunted into another's liberty, the property continues in the owner of the chase or warren. These distinctions show that in general the property is acquired by the seizure or occupancy, though that cannot prevail against the better claim of him in whose grounds the animal is both killed and started. In the United States, subject to the laws against trespass, game can be freely captured or killed; but there are some states which prohibit this during certain seasons in order to encourage the breed. [FOREST LAW.]

Gamerghu, a numerous people of South Bornu, Central Soudan, where they occupy the Ujeh district watered by the Komadugu affluent of Lake Chad. They are a branch of the Ur-Wandalas, and differ in every respect from the Kanuri or ruling people of Bornu. The Gamerghu are muscular, well-made, with deep brown complexion and somewhat regular features, which can scarcely be called negro. Most of them are still pagans, the Mohammedan religion of their Kanuri rulers having penetrated only into the settlements along the main trade routes. Their chief town is Maidugheri, a place situated on the Komadugu, with a population of 15,000. (Rohlf's *Quer Durch Afrika*, Leipzig, 1875, vol. ii.)

Gametes, a sexual reproductive cell in plants, especially among the lower plants in which conjugation occurs. If ciliated, it is termed a *planogamete*; if not, an *aplanogamete*.

Gamopetalous, or COROLLIFLORE, a sub-class of Dicotyledones (q.v.), in many respects more highly organised than either the Thalamiflora (q.v.) or Calyciflora (q.v.). It is characterised by complete and perfect flowers having usually five united sepals, five united petals, five epipetalous stamens, and two united carpels, but exceptional apetalous, polypetalous, and unisexual cases occur. The sub-class is divided into two series, the *Hypogynae*, with a superior ovary, including Labiateæ, Scrophulariaceæ, Convolvulaceæ, Solanaceæ, Boraginaceæ, Gentianaceæ, Oleaceæ, and Ericaceæ; and the *Epigynæ*, with an inferior ovary, including the Campanulaceæ, Composite (q.v.), Rubiaceæ, and Caprifoliaceæ.

Gamut or GAMMUT (from the Greek letter Gamma), the name given to Guido's system of musical notation. In modern music the word is used of the scale of wind instruments.

Gando, an African kingdom of the Western Soudan, on the Niger from Birni in the N. to Iddha in the S., dependent upon Sokoto, and estimated to contain 81,500 square miles. The population of the Housa and Falah races are mostly Mohammedans. The chief town, Gando, is on the Sokoto, a tributary of the Niger, and not far from the town of Sokoto. The principal trading town is Egga.

Ganesa, a Brahmanic god, son of Siva, the god of prudence, whose name is invoked at the beginning of an undertaking, and is to be met with at the head of books and documents. His figure in the temples has an elephant's head, and is riding on a rat.

Ganga. [SAND-GROUSE.]

Ganges, the sacred river of the Hindoos, the bathing in whose waters washes away all sin, rises in Gahrwal (q.v.), from an ice-cave a few miles above the sacred temple of Gangotri, at a height of 13,800 feet. In its early course it is called Bhazirathi, and does not receive the name of Ganges till after flowing nearly 200 miles and receiving the waters of two tributaries. It passes through the Himalayas at Sukhi, and flows S.W. to Hardwar, and then generally S.E. of Allahabad, where it receives the Jumna, and on past Benares through Behar, being joined by three more tributaries, and then flows S., beginning to form its delta at 220 miles from the mouth. The main stream, which receives the Brahmaputra, is to the E., and the Hooghly, on which stands Calcutta, to the W. The upper part of the Delta is fertile, but the lower part is swampy, and numerous canals connect the branches of the river. The whole course is 1,557 miles, and the river drains 390,000 miles of country lying between the Himalayas, Burmah, and the Vindhya Hills. The river is perennial, and enriches the land with the deposit of its inundations, and is navigable for the greater part of its course. Hence perhaps its sacredness.

Ganglion, a sac or cyst formed in connection with a tendon. This condition is most commonly met with at the back of the wrist. Ganglion does not give rise to pain, but the discomfort and unsightliness caused by the swelling usually lead the sufferer from this condition to resort to surgical treatment. A puncture and subsequent pressure usually speedily effect a cure.

Ganglion Cell is the term applied to the nerve-cells which are found in the grey matter of the spinal cord, in the brain, and other nervous tissues. [NERVOUS SYSTEM.]

Gangrene, or MORTIFICATION, is the death of a portion of the animal body. *Gangrene* should be distinguished from *ulceration*. In the former a large portion of tissue and in the latter very minute portions are affected. Thus, gangrene has been termed *molar death*, and mortification *molecular death* of tissue. In gangrene the part of the body involved becomes cold, pale, and shrivelled; there is loss of sensation and general impairment of function. Sometimes the part may be from the outset swollen, sodden, and discoloured. The living tissues which surround the affected part become, after a while, clearly marked off from it by the formation of what is called the line of demarcation. The gangrenous portion or slough is thus ultimately separated and cast off from the body, and when this has occurred healing takes place with the formation of scar tissue. Gangrene is due either to direct destruction of tissue by external agents or to a cutting off of the supply of blood to the part affected; thus, as the result of a burn or from exposure to extreme cold [FROST-BITE], a slough is formed. A severe injury is apt to be followed by death of the tissues involved (traumatic gangrene). When the injured part or wounded surface becomes the seat of septic inflammation, the condition of things is much aggravated, and in such instances the terms *phagedæna* or *hospital gangrene* are used to describe the disease. *Norna* and *cancrum oris* are varieties of phagedæna, which occur in poorly nourished children. In *senile gangrene* the rigid condition of the arteries produced by the atheromatous degeneration, commonly associated with advancing years, interferes with the normal supply of blood, and death of the affected tissues occurs. Lastly, the bed sores which occur in cases of prolonged illness and the curious condition known as ergotism, may be alluded to as varieties of gangrene. Treatment of gangrene consists in maintaining the strength of the patient and carefully protecting the diseased structures from cold, injury, and septic contamination. The question of removing the dead portions of tissue by amputation is, of course, a matter for the judgment of the surgeon.

Gangue. This term is applied to the portion of the rock or earthy material which occurs mixed with metallic ores. The nature of the gangue hence varies with the nature of the rock surrounding the metalliferous lodes or veins, and may consist of felspar, fluorspar, granite, quartz, limestone, etc. The gangue is sometimes useful in the

smelting of the metal, owing to its acting as a "flux," but a great quantity always detracts from the value of the ore. The terms *vernstuff* and *matrix* are also applied with the same signification.

Ganguellas, the collective name of a widespread Bantu people of south-west Africa, whose domain extends from Bihé in Benguela eastwards to the Chobe head-stream of the Zambezi. They comprise five main groups, the Ambuellas, Luimbes, Chibokwes, Luvalés, and Ba-Lundas, all speaking closely-related dialects of a distinct Bantu idiom intermediate between the Umbundi of Angola and the Herero of Damaraland. The term *Ganguella*, meaning "Stammerers," has been applied to them by the A-Bunda people of Angola because of their unintelligible speech, just as the Germans are called *Niemece*, the "Speechless," by their Slav neighbours. The Lundas, most numerous of all the Ganguellas, constitute a powerful nation about the headwaters of the Liba affluent of the Zambezi. They have long had indirect relations with the Portuguese through the Lihé traders, and most of the beeswax exported from Angola comes from their country. The Lundas are amongst the few African peoples who respect their women, some of whom even rise to the rank of queens. (Serpa Pinto *Comment j'ai traversé l'Afrique*, Paris, 1881.)

Ganjam, a district of India lying along the Bay of Bengal, in the N.E. of the Madras Residency. The town of the same name is 18 miles N.E. of Berhampur, and was once the chief town of the civil district, but it is now decayed, and its place is taken by Berhampur.

Gannet, any bird of the genus *Sula*, with eight species, belonging to the Pelican family, and universally distributed in cold and temperate regions. The face and neck are naked; the bill is straight and strong, and longer than the head; the four toes are long and united by a membrane. The gannets are good swimmers and divers, very powerful on the wing, living on fish, and nesting socially on rocky cliffs and islands. The best-known species is the Common Gannet or Solan Goose (*S. bassana*), a British bird, breeding on Ailsa Craig, the Bass Rock (whence it derives its specific name), Lundy, St. Kilda, and on the Skellings off the coast of Kerry. The nests are rude structures of seaweed, and each contains but a single white egg. The adult male is a little under three feet long, and has the naked skin of the face blue, head and neck buff, primaries black, and the rest of the plumage white. The young during their first year are black, marked with lines and dots of white, so that the chief resemblance between young and adult birds is in the long, straight bill. Large numbers of the young birds are taken every year at the Bass for the sake of their down. The flesh of old birds is rank, but that of the young is valued for food, and both young and old birds yield oil. The eggs are considered a delicacy. *S. variegata*, from the Southern hemisphere, is one of the birds that have formed the guano deposits in the Pacific islands. [BOOBY.]

Gannister, a hard, fine-grained sandstone, occurring in the Lower Coal Measure series. It is

used for road-metal; or, when ground down, in iron- and brass-casting; or, mixed with fire-clay, in making fire-bricks and lining furnaces.

Ganoid Fishes, an order containing only seven recent genera, though to it belonged most of the palaeozoic and mesozoic fossil forms. [BONY PIKE, FISHES, MUD-FISH (*Amia*).]

Ganteaume, HONORÉ, a very distinguished French sailor, was born at La Ciotat in 1751, and commanded the *Trente-et-un Mai* on the Glorious First of June, 1794, and as *chef-de-division* in the *Mont-Blanc*, 74, a squadron which escaped from Toulon in 1795. He was subsequently one of the commanders of the Invasion Flotilla, was captain of the fleet to Vice-Admiral Brueys at the seizure of Malta and at the battle of the Nile, and as rear-admiral, in the *Miron*, brought back Bonaparte from Egypt. In 1801 he commanded the expeditionary fleet to Egypt, and, in 1802, a division of the expedition to St. Domingo. As vice-admiral he commanded the Brest Fleet in 1804, the Toulon Fleet in 1808, and a still larger Toulon Fleet in 1809. One of the bravest and most capable admirals in the French service, his death, in 1818, was regarded as a national catastrophe.

Ganymede, in Greek mythology, the cup-bearer of Zeus. According to one account, he was the son of King Tros and Callirhoe, and Zeus, noticing his comeliness, sent the eagle to bear him away to heaven. He figures in the zodiac as Aquarius, and the rape of Ganymede has formed a subject for poet, sculptor, and painter. One of Horace's finest odes mentions the legend. Thorwaldsen has commemorated it, and the flight on the eagle is the subject of a fine picture of the school of Titian at present in the National Gallery, London.

Gapes, a disease which occurs in chickens and other birds. It is caused by the presence of parasitic worms in the trachea or windpipe.

Garanceux. [GARANCINE.]

Garancine is a preparation of madder-root, which was formerly very largely employed in the dyeing industry. It is obtained by the action of (1) dilute, (2) strong, sulphuric acid, upon the root. It possesses about four times the colouring-power of the madder itself, and also gives better colours. A poorer quality obtained from spent madder is known as *garanceux*. Both these, like all other madder extractions or preparations, are now almost entirely superseded by the artificially-prepared *alizarine* (q.v.), which forms the colour-principle of them all.

Garay, JANOS (1812-1853), a Hungarian poet, lived at Pesth. He wrote dramas, an epic poem, an historical poem, made a poetical collection of historical legends, and wrote lyrics. A complete edition of his works and a life of him have been published.

Garcia, MANUEL (1775-1832), a singer and composer, was born at Seville. He first appeared as a tenor at Cadiz and Madrid, and in 1808 sang in Italian opera at Paris. He went also to Italy and to London, and in 1825 travelled with a company

to New York and Mexico. On this expedition he was robbed, and was compelled upon his return to Paris to give singing lessons for a livelihood, as his voice had gone. Two of his pupils were his daughters, Pauline and Maria, better known as Mesdames Viardot-Garcia and Malibran. His best composition was the *Caliph of Bagdad*. His son, Manuel (b. 1805), earned a great reputation as a teacher of singing, and invented the laryngoscope. His hundredth birthday was celebrated in 1905 with great enthusiasm. He died in 1906.

Garcilaso (1540-1616), a Spanish historian, was born at Cuzco, his father being a Spanish soldier and his mother a princess of the Incas, whence he is sometimes called "Inca." He went to Spain in early manhood, and lived at Cordova. His work *La Florida del Inca* (1605), giving an account of Ferdinand de Soto's conquest, and his *Royal Commentaries* on Peru, were translated into English in 1688 and in 1869.

Garcilaso de la Vega (1503-1536), a Spanish soldier-poet, was born at Toledo. He fought in Charles V.'s army against the French and the Turks, and was mortally wounded at the siege of the castle of Fréjus. He was the first to introduce Italian hendecasyllabics into Spain, and was imitated by Lope de Vega, and is often quoted and commended by Cervantes.

Gard, a department of France on the Mediterranean, and lying W. of the Rhône, and containing 2,245 square miles, is watered by the Rhône and its tributaries, the Gard and the Cèze. In the N.W. is a branch of the Cevennes, and the remainder of the department slopes towards the Rhône and the Mediterranean, the coast being somewhat unhealthy by reason of its marshes and great summer heat. Many olives and chestnuts are grown, and silk-worms are reared. Coal, iron, lead, marble, salt, and antimony are among the minerals, and there are important iron and steel works. Nîmes is the capital, ten miles to the N.E. of which is the *Pont du Gard*, an aqueduct, one of the most magnificent of Roman remains in France.

Garda, LAGO DI, between Lombardy and Venetia, is the largest of the Italian lakes, being 35 miles long, with an average of 7 broad, and containing 115 square miles. It is more than 200 feet above sea-level, and is almost a thousand feet deep. The rivers Sarca and Ponale flow into it, and the Mincio drains it into the Po. The upper end (Riva) is Austrian and the rest Italian. The district is a favourite health-resort for its fine climate, the neighbourhood of the lake containing many villas. The Alpine spurs in the N. are interspersed with pretty valleys, and the southern slopes grow citron, figs, grapes, myrtles, and mulberries. The principal productions are olives and fish, which are abundant. On a peninsula jutting from the south shore is Sermione, mentioned by Catullus, with Roman remains.

Gardais, a town of Algeria, is situated in an oasis of the Sahara, and forms part of the territory claimed by France. It is surrounded by a low wall, and there is a modern French fort. The town lies 82 miles N.W. of Wargla.

Gardenia, a genus of trees and shrubs, belonging to the tribe Cinchonæ of the order Rubiaceæ, which are natives of tropical Asia and Africa, and of the Cape, and are valued for their fragrant white flowers. *G. florida*, the "Cape Jasmine," has generally double flowers.

Gardening. [HORTICULTURE.]

Gardiner, JAMES (1688-1745), was a British officer born at Carriden in Linlithgowshire. He became an ensign at 14 in a Scottish regiment in the Dutch service, which service he abandoned in 1712 for that of Queen Anne. In 1706 he was wounded at Ramillies, and he fought at the battle of Preston in a Dragoon regiment. In 1704 he was a major in the 1st Inniskillings, becoming lieutenant-colonel of the regiment in 1730. About this time he experienced "conversion," a process which did not destroy his soldierly qualities. In 1743 he became colonel of the 13th Light Dragoons, and in 1745 died bravely at the battle of Prestonpans.

Gardiner, SAMUEL, historian, was born in 1829 in Hampshire, and was educated at Winchester and Christ Church. He then became Professor of Modern History at King's College, London, till in 1885 he was elected Fellow of All Souls'. His historical studies chiefly dealt with the time of James I. and Charles I., and his work is divided into these periods; *James I. to the Disgrace of Coke, Prince Charles and the Spanish Marriage Schemes, England under the Duke of Buckingham and Charles I., The Personal Government of Charles I., and the Fall of the Monarchy of Charles I.* (only to 1642); all of which were afterwards gathered into ten volumes of *History of England*. He wrote other historical works, and collaborated in an *Introduction to English History*, and also edited several works for the Camden Society. He died in 1902.

Gardiner, STEPHEN, Bishop (1483-1555), was born at Bury St. Edmunds. He was educated at Trinity Hall, Cambridge, of which society he became a fellow. In 1524 he lectured, and was appointed tutor to the Duke of Norfolk's sons, and introduced to Cardinal Wolsey, to whom he became private secretary. From 1525-1539 he was Master of Trinity Hall. In 1527 he accompanied Wolsey to France, and made the acquaintance of Erasmus. In 1528 he was sent on an embassy to the Pope, and soon went again to Italy on business connected with the royal divorce. In 1529 he was in high favour at court, and was able to intercede for Wolsey, and endeavoured to save the cardinal's colleges at Ipswich and Oxford, being successful, however, only in the case of the latter. In 1531 his services in the matter of the divorce gained him the bishopric of Winchester, and in 1532 he was with Henry at Calais. He has been accused, and with some apparent reason, of double-dealing in the matter of the divorce and in his general ecclesiastical attitude. In 1534 he renounced allegiance to Rome, and wrote a treatise *De Verâ Obedientiâ*, which gained him the odium of orthodox Catholics. His opposition to Cromwell made him suspected at court, but in 1535 he was again in favour, and acting as ambassador to France. In 1538 Bonner

superseded him at Paris, but in 1539 he was ambassador to Germany. He gave offence to Protestants both at home and abroad by promoting the Six Articles. At the accession of Edward VI. Gardiner fell upon evil days, and was for a time in the Fleet. He then retired to Lambeth, but was arraigned upon various charges, and was committed to the Tower. Mary's accession set him free, and he crowned her, and was made Lord Chancellor. He was prominent in the persecutions of her reign.

Gardner, LORD. Two British naval officers of note have borne this title. The first, ALAN GARDNER, born in 1742, was son of Lieutenant-Colonel Gardner, and, before becoming a lieutenant, was present in the glorious battle of Quiberon Bay in 1759. He was made commander in 1762, and captain in 1766. In the *Maidstone*, 28, he signalled himself by the capture of the *Lion*, 40, and in the *Sultan*, 74, he behaved with remarkable bravery in Byron's action off Grenada in 1779, and in Cornwallis's action with M. de Ternay in 1780. In the *Duke*, 98, he took part in Rodney's actions in the West Indies in 1782, and, on April 12, was the first to break the French line. In 1791 he was made a Lord of the Admiralty; in 1793 a rear-admiral; and in 1794 was one of the flag-officers in Howe's victory of June 1st. For this service he was made a baronet, and promoted to be vice-admiral. In 1795 he bore a slight part in Bridport's action, and in 1797, on the occasion of the mutiny in the fleet, distinguished himself not less by his zeal than by his rashness and threatened severity. He became a full admiral in 1799, and in 1800 was created an Irish baron, and in 1806 a baron of the United Kingdom. After having for a brief space commanded the Channel Fleet, he died in 1809. His son and successor, ALAN HYDE, born in 1772, became a captain in 1790, a rear-admiral in 1808, and a vice-admiral in 1813. In 1796 he secured the surrender of the Dutch possessions in Ceylon; in 1805 he commanded the *Hero*, 74, in Calder's action, and later in the same year he assisted in Strachan's victory. After his promotion to flag-rank he commanded a squadron that observed the Scheldt and Texel. His death occurred in 1815.

Garfield, JAMES ABRAM (1821-1881), President of the United States of America, was born in Ohio, his father being of an old Puritan family, and his mother of Huguenot descent. His father died, and his mother was left in poor circumstances. The boy worked on farms and the Erie canal-boats in summer, and went to school and afterwards to College in winter. He became, in 1857, President of Hiram College, and in 1859 was elected to the State Senate; and when the War of Secession broke out had command of the 42nd Ohio Volunteers. In 1862 as brigadier-general he won the battle of Middle Creek, and in 1863 was made major-general. He sat in Congress till 1880, in which year he became a United States senator and Republican candidate for the Presidency, and was elected. His efforts in the direction of Civil Service reform gave offence to many, and on the 2nd of July, 1881, he was shot by a half-lunatic office-seeker. He died on September 1st.

Garfish, any fish of the Teleostean genus Belone, with about fifty species from tropical and temperate seas. The body is greatly elongated, and the jaws prolonged into a kind of beak, with widely-set teeth; the dorsal fin is opposite the anal. The jaws in the young fish are of normal shape. *B. vulgaris*, a fairly common British fish, is about two feet in length. The flesh is well-flavoured, but some persons are prejudiced against it, because the bones, like those of the rest of the genus, are green in colour.

Garganey. [TEAL.]

Gargle, a preparation intended for application in diseased conditions of throat and tonsils. The active principle in a gargle is usually either some astringent substance, such as alum or tannic acid, or a mild antiseptic (Condyl's fluid, etc.).

Gargoyle, in Gothic architecture, a projecting spout to carry away the water from the gutter surrounding a roof. They are usually carved into figures of angels, men, human faces, or animals, and are often very grotesque. The water issues either from the mouth of the figure or from a leaden spout above or beneath it.

Garhwāl, a native state of the North-West Provinces of India, bordering on Thibet, and having an area of 4,180 square miles. There is also a British district adjoining, 5,500 square miles in area, and having mountain ranges of over 25,000 feet in height. The Jumna and the Ganges rise in the native state, and in the district the Bhagartathi joins with a tributary to form the Ganges. Gangotri [GANGES] attracts many pilgrims.

Garhwālī, the natives of British and Independent Garhwāl, West Thibet, who are of Thibetan (Mongolic) stock, but Aryan (Caucasic) speech, now speaking Neo-Sanskritic dialects closely related to Kashmiri. Here are also the Rongbo, and north of them the Kohli, Kakka, Gakar, Avan, and Janju peoples, all of mixed Indo-Thibetan stock, in which the Hindu element largely prevails. The native Rajputs, collectively known as Rhasiya, have lost caste by mixture with non-Aryan populations. The Avans (Awans) are supposed by some ethnologists to be descended of the Yavana—that is, Ionians or Greeks, settled in this region at the time of the Macedonian invasion.

Garibaldi, GIUSEPPE (1807-1882), one of the apostles and active instruments of Italian freedom, was born at Nice. He became a sailor, and in his twenty-first year was in command of a merchant brig. At Marseilles he met Mazzini, who fired him with his own enthusiasm, and induced him to join the abortive Genoese revolution of 1833. For his share in this, Garibaldi was condemned to death, but escaped to Brazil, where he joined the revolutionists in Rio Grande, and did much service as a guerrilla leader and privateer. He was made prisoner, and (being separated from his unfaithful wife) became associated with a devoted Creole, Anita, who till her death was the faithful companion of his wanderings. He aided, in 1842, the Montevideans

against the Dictator of Buenos Ayres. The advent of Pius IX., with all its hopes, in 1847, found him in Italy, but he was coolly received by the Pope, and by Charles Albert of Sardinia. He fought against the Austrians, however, in S. Tyrol, and in 1849 joined the revolutionary government at Rome, and drove out the French and Neapolitans, but he defended it in vain against a siege, and was pursued to the Adriatic, Anita dying in the flight. Being banished, he went to New York, worked in a soap factory on Staten Island, and took to the sea again. In 1854 he returned to Italy, and farmed on the isle of Caprera. In 1859 he was summoned by Cavour to Turin, and had a great part assigned to him in the War of Liberation. He was the heart and soul of the expedition against the Neapolitan kingdom, which put Victor Emanuel on the Italian throne, but the renunciation of Rome and the cession of Savoy and Nice disgusted him, and he retired to Caprera. In 1862 he undertook an expedition against Rome, but was checked by the Italian troops at the battle of Aspromonte, where he was badly wounded in the foot. Soon after this he visited England, but though received with much popular applause, he failed in the object of the visit—to get England to take up the cause of Denmark against Prussia. In 1868 he made his ill-advised attempt upon Rome, and was defeated at Mentana by French troops. The rest of his life was passed in comparative retirement, save when in 1870 he hastened to put his sword and life at the disposal of the French republic, and commanded the irregular forces of the Vosges. He was elected deputy to the French National Assembly in 1871, but was refused admission as being a foreigner. For the latter part of his life Garibaldi possessed the isle of Caprera.

Garlic (*Allium sativum*), a bulbous perennial plant belonging to the order Liliaceæ, and probably native to the south of Europe. Its bulb-scales are membranous and 10 to 12 in number, each having a "clove" or small bulb in its axil capable of independent growth. The leaves are linear and slightly keeled: the spathe is deciduous: the globose umbel bears bulbs among its flower-stalks, and the perianth-leaves are white. The whole plant, and especially the bulb, has an acrid taste and a strong smell of allyl sulphide (C_3H_5)₂S. It has been used for food from the earliest times in Egypt (Numbers xi. 5), in Greece and Italy, and was considered valuable medicinally. The name is popularly applied to several wild species of Allium, and to the cruciferous *Erysimum Alliaria*, which has the same smell and taste.

Garlic, OIL OF. A brown oil which is obtained when the leaves or other parts of garlic are distilled with steam. It also occurs in many allied plants, and some *cruciferae*. If purified by redistillation, it is obtained as a pale yellow liquid, with a peculiar and disagreeable garlic-like odour, which boils at 140° C. It may be artificially produced, and its syntheses, as well as its analysis and reactions, show that it consists of sulphide of allyl, and must be represented by the formula (C_3H_5)₂S.

Garnet, from the Latin *granatum*, the pomegranate, the seeds of which some granular varieties resemble, is the general name for a group of isomorphous silicates, crystallising in rhombic dodecahedra or icositetrahedra belonging to the Cubic system. They have the general chemical formula $3R^{II}O \cdot R^{IV}_2O_3 \cdot 8SiO_4$, in which R^{II} is calcium, magnesium, iron and manganese, and R^{IV} is aluminium, iron, and chromium. The chief varieties may be classified as follows:—(1) lime-alumina garnet, including the olive-green *grossularite* and the brown or yellow *cinnamon-stone* or *essexite* of Ceylon; (2) magnesia-lime-iron-alumina garnet, including the blood-red or dark crimson *pyrope* or *Bohemian garnet* found in serpentine and sometimes cut as a *caruncle* (q.v.); (3) iron-alumina garnet, brownish-red to crimson and amethystine-purple, including the common and often large garnets in mica-schists and gneiss and the precious garnet or *almandine*; (4) lime-iron garnet including *melanite*, a black form found in volcanic rocks, and *aploite*, a brown or greenish form; (5) manganese-alumina garnet or *spessartite*, a brownish-red, which occurs in the Belgian "coticules" or hone-stones; and (6) lime-chromium garnet, the emerald-green *Ovavrorite* or *uvavarovite* of the Urals. In hardness garnets range from 6·5 to 7·5; in specific gravity from 3·15 to 4·3. The streak is always white or whitish, and the fracture sub-conchooidal. They vary from considerable transparency to opacity, and from a truly vitreous to a resinous lustre.

Garnett, HENRY (1555–1606), an English Jesuit, was born at Heanor in Derbyshire. He was a scholar of Winchester College, and, becoming a Catholic, came to London, where he studied law and corrected the press for a law printer. He then went to Spain and Italy, and became a Jesuit in 1575. In 1587 he was sent as missionary to England, a position for which his gentle and retiring nature little fitted him. After the Gunpowder Plot a letter found upon Guy Fawkes drew suspicion upon Garnett, and he was for a time hidden with another priest at Hindlip Hall. Forced at last to yield through want of air and movement, he was committed to the Tower. His trial came off in 1606, the judge being Chief Justice Popham, who had known him in former days, and Coke being the prosecutor. He was condemned and executed.

Garnett, RICHARD (1789–1853), an English philologist, was born at Otley in Yorkshire, and was educated at the grammar school there, and learnt, besides French, Italian and German. In 1811 he became assistant-master in a school at Southwell, and learnt Greek, Latin, Divinity, and took orders. In 1838 he was appointed assistant-keeper of printed books in the British Museum. He gave special attention to Keltic, and wrote many articles in the *Quarterly Review*, and contributed to the *Transactions* of the Philological Society, of which he was a member. Among his works are treatises on *The Languages and Dialects of the British Isles*, *The Nature and Analysis of the Verb*, and *The Formation of Ice at the Bottom of Water*. His son, RICHARD, was keeper of the printed books from 1890–9.

Garnier-Pagès, ÉTIENNE JOSEPH (1801–1847), was born at Marseilles, where he practised at the bar. He took part in the Revolution of July, and in 1831 became a member of the legislative chamber. LOUIS ANTOINE (1808–1878), half brother of the above, also joined in the July Revolution, and succeeded to his brother's position and led the Extreme Left. In 1848 he became mayor of Paris, in 1864 a member of the Corps Législatif, and in 1871 a member of the Provisional Government.

Garo (GARROW), the most primitive branch of the Kachâri people, Garo Hills and Goalpara Kamrup and Mymensingh districts, West Assam. There are three main divisions—*Abong* in the south-east, *Abengga* in the south-west, and *Achi* elsewhere, with total population about 110,000, of whom over 80,000 are in the Garo Hills. The collective national name is *Mande*, and all speak dialects of a language closely akin to the Bodo (Kachâri) of North-east Assam. The Garo are of Mongolian type, with black, oblique eyes, flat features, dirty-yellowish complexion, short, squat figures, sulky expression. Like their Khassia neighbours, they raise rude monolithic monuments, similar to those of North Africa, Brittany, and Stonehenge, and their religion is a gross fetishism, formerly accompanied by human sacrifices. (Dalton, *Ethnology of Bengal*; Major Godwin Austen, *On the Garo Hills* in *Journal of the Royal Geographical Society*, 1875.)

Garonne, THE, a river of France (Latin *Garunna*), rises in the Spanish Pyrenees, flows through a gorge, and enters France near Pont du Roi, and flows N.W., and, joining with the Dordogne widens out two or three miles to form the Gironde and falls into the Bay of Biscay. The islands and banks of the estuary form two channels, and the lower parts are subject to inundation. On the right bank are the tributary Salat, Ariège, Tarn, Lot, and Dordogne, and on the left the Neste, Bouge, Save, Gers, Baise, and Ciron. Boats can go upwards from Toulouse to the junction of the Salat and sea-going vessels can go thirty-two miles above Bordeaux.

Garonne, HAUTE, frontier department of France, bordering upon Spain, along the Pyrenees. It is 99 miles long by 56 miles broad, and contains 2,428 square miles. The N. is generally fertile, and in parts mountainous, and in the S. the Pyrenees rise to a height of 11,000 feet. All the rivers belong to the Garonne, and the Canal du Midi passes through. The climate is mild, but during part of the year high winds are prevalent. The oak, pine and fir are the most abundant trees, and among the chief products are wheat, maize, oats, potatoes and fruits. Cattle and sheep are reared, and the region is especially noted for its mules and asses. Among the minerals are iron, lead, copper, coal, marble, and granite. Toulouse is the capital.

Gar-pike, a name sometimes given to the garfish (q.v.), but properly belonging to the Bony Pike (q.v.).

Garrick, DAVID, generally acknowledged as the greatest actor that the English stage has seen,

was born at Hereford on the 20th of February, 1717. He received a good education, studying for some little time under Dr. Johnson at Edial, near Lichfield, and with his teacher set out to seek his fortune in London in 1737. Legal studies did not prove attractive, and a year later he joined his elder brother Peter in a wine merchant's business, which partnership, not proving profitable, came to an end in 1740. At last he found his vocation, appearing on the stage in Southerne's *Oronooko* in 1741 at Ipswich, and on October 19th of the same year as Richard III. at the theatre in Goodman's Fields, London. At the latter place his success was phenomenal, and drew down the displeasure of the managers of the two Patent Houses, who succeeded in stopping the performances. Garrick finally settled down at Drury Lane, of which theatre he became joint patentee in 1747, and retained the management till he retired from the stage on June 10th, 1776. When Garrick appeared on the scene, the stage was eaten up with formality and custom, stately declamation and stereotyped attitude and gesture were the actor's stock-in-trade; but against all this he daringly revolted, and soon the artificial gave place to a more natural method of acting. In every class of piece Garrick was eminent, being successful in the highest tragedy and the lowest comedy. His variety was infinite. As a dramatic author he was more voluminous than meritorious, but many of his shorter verse productions are bright and clever. He was frequently accused of pettiness and meanness, and probably his character was not altogether estimable; but his invariable success doubtless irritated many who considered themselves injured by his triumphs. He died on the 20th of January, 1779. He married in 1749 Madame Violette, a famous dancer, who survived him till 1822.

Garrison, WILLIAM LLOYD (1805-1879), a noted American abolitionist, was born at Newburyport in Massachusetts. His father, a sea-captain, disappeared, and his mother was left in poor circumstances. The boy tried his hand at shoemaking and at cabinet-making, and eventually was engaged in the printing department of a local newspaper, for which he wrote anonymously, and he also wrote some political articles for the *Salem Gazette*. In 1829 he went to Baltimore, and joined with a Quaker philanthropist, Mr. Lundy, to advance the cause of emancipation. Mr. Lundy was in favour of gradual emancipation and the foundation of a free colony in Africa, but Garrison was more uncompromising, and advocated immediate and total emancipation and the bestowal on the blacks of full citizenship. In the course of his efforts he rendered himself liable for libel, and was imprisoned. In Boston he started the *Liberator* newspaper, and suffered much privation in the early days of the paper. In 1833 he visited England for the first time, and was warmly received by Wilberforce and the other opponents of slavery. Garrison may be looked on as one of the chief causes of the final abolition of slavery in 1864.

Garrot. [WILD DUCK.]

Garrotte, a form of capital punishment in use in Spain and Portugal. In former days the prisoner was strangled by means of an iron collar, which was placed round his neck and fastened to a stake at the back of the chair in which he sat. At the point where the stake and collar met there was a screw, the turning of which resulted in the contraction of the collar. Death is now inflicted by making the screw pierce the spinal marrow where it joins the brain. The term "garrotting" is applied to a kind of highway robbery, in which the robber makes his victim insensible by suddenly compressing his throat.

Garter. The Order of the Garter was instituted by Edward III. in honour of Edward the Confessor and St. George of Cappadocia, probably between 1344 and 1348. Roughly speaking, there are two theories as to its origin. According to one theory, it was established with the definite purpose of encouraging valour in the French war by commemorating victories and rewarding those who specially distinguished themselves. The supporters of the other view appeal to the legend that the king, having in the course of a dance picked up the garter of a lady, whom tradition identifies with the Countess of Salisbury, returned it to her with the exclamation, "*Honi soit qui mal y pense*" ("Shamed be he who thinks evil of it"), which became the motto of the new order. The order originally consisted of the king, the Prince of Wales, and 24 knight-companions, who had stalls in St. George's Chapel at Windsor, where they assembled on the eve of St. George's Day (April 23). Later statutes permitted the election of foreigners and descendants of George III. (1786), George II. (1805), and George I. (1831), in addition to the original number. The right of election was at first vested in the whole body, but was afterwards confined to the king. The officers of the order are the Prelate (the Bishop of Winchester), the Chancellor (the Bishop of Oxford), the Registrar (the Dean of Windsor), the Garter King of Arms, and the Gentleman Usher of the Black Rod. The original insignia of the order were a garter, a surcoat, a mantle, and a hood, to which the collar and George, star, and under-habit were afterwards added. The garter, which is worn a little below the left knee, is now made of dark blue velvet, and has the motto inscribed on it in gold letters. The mantle, surcoat, and hood are all of velvet lined with white taffeta, the colour of the two latter being crimson and that of the mantle purple. The badge, a silver escutcheon bearing a red cross and surrounded by the garter and motto, is worn on the left shoulder of the mantle. The collar contains 26 pieces, roses alternating with knotted cords, and from it hangs the "George," a representation of St. George slaying the dragon.

Garth, SIR SAMUEL (1661-1719), an English physician and poet, was born in the West Riding of Yorkshire, and was educated at Ingleton and at Peterhouse, Cambridge, where he graduated B.A. in 1679, and, after studying at Leyden, M.D. in 1691. He came to London and was F.C.P. in 1693. In 1697 he gave the Harveian oration, in the course

of which he broached the idea of establishing dispensaries where the poor should get good advice and aid free. This idea was strongly opposed by the apothecaries, as surgeons were then called, and they tried every means to thwart its realisation. In 1699 Garth published *The Dispensary*, a poem which seems to have been modelled upon *Le Lutrin* of Boileau and Dryden's MacFlecknoe. In 1700 Garth delivered a Latin oration upon Dryden. He also wrote verses for the Kit-cat Club, as well as other poems, and some dramatic prologues. On the accession of George I. he was knighted and appointed physician-in-ordinary to the king.

Gas is a substance whose particles exhibit a tendency to separate from one another. If a quantity of gas be introduced into a closed vessel, that quantity will immediately fill the vessel, retaining neither its original form nor its original volume. A gas may therefore be regarded as a substance possessing no rigidity; the smallest forces may deform it, and a removal of those forces will not necessarily be accompanied by a return to the original shape. This special property is shared with liquids, from which gases are distinguishable by having a very great elasticity of bulk. Small forces may produce very great change in volume. The gaseous condition seems to be one in which the particles of the substance are endowed with a greater amount of kinetic energy than they possessed when the substance was in the liquid form. They are therefore able to separate themselves and to travel about independently in rectilinear courses, except in so far as collisions with other particles may alter their lines of motion. The particles of a given quantity of gas at a certain definite temperature possess a certain amount of momentum, and if this is altered in direction by their collision with the sides of the containing vessel the incessant impact produces a fairly constant and uniform pressure on the sides of the vessel. We say fairly constant, because the particles have not all got exactly the same speed, nor are they all exactly the same distance apart; but, taking them as a whole, they may each be regarded as possessing an average amount of energy, an average speed, and an average distance between each other. If the vessel be diminished in size, the number of impacts it receives per second will be increased, and for the same temperature as before the gas exerts a greater pressure. This is the basis of the kinetic theory of gases developed by Clausius and Clerk-Maxwell which now receives the general support of physicists. Both theoretical and practical considerations have shown that the pressure is inversely proportional to the volume for a given quantity of gas at a constant temperature. If v is the volume of the gas and p its pressure per unit area, the product pv will remain a constant through a wide range of pressures. This law, which is known in England as *Boyle's Law* (q.v.), is not perfectly true, considerable error being found when the pressures are great and the particles of gas too closely aggregated. The second important law of gases is due to Gay-Lussac, who showed that the increase of volume which a quantity of gas undergoes when its

temperature is increased 1° , in order to maintain constant pressure, is a fixed proportion of its initial volume at 0° C. This is expressed mathematically by the formula $v_t = v_0(1 + at)$, where v_t is the volume at the temperature t degrees, v_0 that at 0° C. , and a a constant that is practically the same for all gases, being about $\frac{1}{273}$. This constant is called the *coefficient of expansion*.

Gases may be liquefied by the combined application of great pressure and great cold. For every gas there is a certain temperature, known as the critical temperature, which must be reached before pressure alone can complete the liquefaction. When the gas is below the critical temperature it is called a vapour, and may be liquefied without further diminution of temperature.

Gases vary in their degree of solubility in liquids; 1,050 litres of ammonia are soluble in 1 litre of water at 0° C. ; while only .02 litre of hydrogen can be dissolved in the same amount of water. A liquid at its boiling-point may be regarded as being saturated with its own gas, any addition of heat causing the evolution of vapour. The power of conduction of heat for gases is very slight, and is difficult to measure, for true conduction is prevented by the convection which goes on. The specific heat of gases is small as a rule, that of air at constant pressure being .2375, at constant volume .1684; that is to say, a gramme of air raised in temperature 1° C. requires .2375 calories if its pressure remain constant, its volume therefore increasing by Gay-Lussac's law. If its volume be kept constant it requires only .1684 calories to raise its temperature 1° C. , the difference being due to the work done in the former instance by expansion of the air against the external pressure. The specific heat of hydrogen at constant pressure is 3.049, this substance being the unique exception to the rule that the specific heats of all substances are less than that of water. Air at ordinary temperatures and pressures is an insulator of electricity, but at high temperatures and at low pressures it becomes a conductor. Oxygen is strongly magnetic; hydrogen and nitrogen are diamagnetic. [DIAMAGNETISM.]

Gas Analysis. The first operation in gas analysis is the collection of the sample, and this frequently offers a great many difficulties. In ordinary cases the gas is collected in glass vessels over water or mercury, the former being most convenient, but only applicable when the gas to be analysed contains no soluble constituents. The vessels are filled with the liquid, and then by means of a tube attached to their upper end are placed in communication with the chamber, etc., containing the gas. The mercury or water is then run out from below, the gas being thus aspirated into the vessel which, when full, is securely closed. The sample being thus collected, the method usually adopted for its analysis is the absorption in turn of each of its various constituents, by suitable substances, the decrease in volume after each absorption being observed. For this purpose the gas is transferred to a graduated measuring tube, and from this it is forced into the bulb containing the particular absorbent, being again forced back

into the measuring tube. Owing to the alteration of the volume of a gas with variations in the temperature and barometric pressure [GAS], these data must be also noticed at each observation. The principal substances employed as absorbents are the following:—*Caustic potash*, either solid or in solution, which absorbs acids, or their anhydrides, being most frequently used for the determination of *carbonic acid* CO_2 . *Pyrogallol* or *pyrogallio acid*, which is used to absorb oxygen, for which purpose also *phosphorus* may be employed. *Cuprous chloride*, either in acid or in ammoniacal solution, used chiefly for determination of carbon monoxide, acetylene, or oxygen. *Sulphuric acid* (1) *dilute*, by which basic gases, as ammonia, etc., are absorbed; (2) *concentrated*, by which olefiant gas and allied compounds can be estimated. *Bromine* can also be employed for these latter, while *nitric acid* is used to absorb vapours of benzene. Besides these, *alcohol*, *lead acetate*, and other substances are used in special cases. Many gases, however, containing carbon, oxygen, hydrogen, and nitrogen, cannot be estimated by any of the preceding, and these are then determined by exploding with a known and sufficiently large volume of oxygen in a graduated tube known as an *eudiometer*. From the volume of gas before and after explosion, and also the quantity of carbonic acid, CO_2 (determined as above), and of aqueous vapour (found by heating the tube to 100°C .) formed, the quantities of all four constituents in the original gas can be determined. For the determination of a single constituent of gases, special methods are frequently employed—e.g. as by absorption in some liquid, and afterwards analysing the solution obtained.

Gas Battery, in electricity, is a voltaic battery first arranged by Grove, in which oxygen and hydrogen act as the opposite poles, and dilute sulphuric acid as the electrolyte separating them. The gases are contained in long glass tubes held in position over the liquid. The terminals of the battery are connected with platinum plates that pass up from the liquid into each tube. The electromotive force available is about 1.5 volts, and is the electromotive force required to separate hydrogen and oxygen from water.

Gascoigne, SIR WILLIAM (*cir.* 1350–1419), an English judge, was born at Gawthorpe, in Yorkshire, and educated at Cambridge. He became a member of the Inner Temple, and pleaded in Richard II's reign. In 1397 he became King's Sergeant, and held an estate for the banished Duke of Hereford, who, upon his accession, confirmed Gascoigne's patent as King's Sergeant, and made him Lord Chief Justice in 1400. He is said to have tried Northumberland and the other rebels in 1405, but this is very doubtful. The story of his collision with the Prince of Wales and his imprisonment of the prince is probably apocryphal. He appears to have been a good judge, and his son served in the wars of Henry V., and became High Sheriff of York, while his grandson was knighted by Henry VII.

Gascons, the inhabitants of Gascony, southwest France, who are distinguished by some marked

characteristics from all the surrounding populations—characteristics due to their mixed Iberian, Romano-Gallic, and Teutonic (Visigothic) descent. The substratum of the population is certainly Iberian, as shown by their very name—*Gascon* and *Vascon* being the same word as Basque [*BASQUE*]—and by such local names as *Elimberris*, *Bigorra*, *Iluro* and other old Iberian settlements, whose meaning is still explicable by the Basque language (*Elimberris* = “New-town,” etc.). Later, but still in prehistoric times, the country was invaded by Celtic (Gaulish) tribes, who merged with the original inhabitants, forming the mixed Celtiberian peoples, who retained the primitive Iberian speech still surviving on both slopes of the Western Pyrenees. These Celtiberians were the Aquitani of *Caesar* (*De Bell. Gall.* i. 1.), who after the Roman conquest (29 B.C.) were grouped in nine administrative districts forming the *Ninem popularia* of the Empire. After the Visigothic irruption the Vascons of the Pyrenees again acquired the ascendancy, and in the seventh century extended their rule and name to the whole region northwards to the Garonne, which from the remotest times had formed the northern boundary of the Iberian domain. Thus it was that this region took the name of *Vascony* (Gascony), which it still bears, though since 1790 divided into several administrative departments roughly corresponding to the *Norem populi* of the Romans. The Basque language, however, has gradually retreated to the south-western districts of Navarre and Oleron (the ancient *Iluro*), and the bulk of the people now speak, besides the standard French, a marked dialect of the *Langue d'Oc*. The Gascons are distinguished by a higher tone of morality, due perhaps to their Iberian blood, than is prevalent in other parts of France. They are a gay, cheerful, and hospitable people, somewhat boisterous in their demonstration of friendship, great talkers and even charlatans, given much to exaggeration and “bounce,” so much so that the term “gasconade” has become synonymous with brag, bluster, or bravado. The modern “gasconader” represents the *miles gloriosus* of Roman comedy.

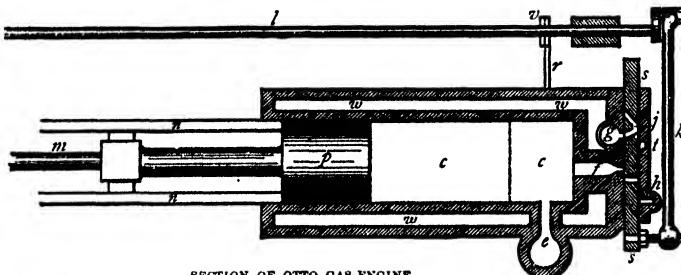
Gascony, an old province of France containing 10,000 square miles, was the Aquitania Tertia of the Romans, and seems to have been settled by “Vasques” or “Vascons” from Spain. These were defeated in 602 by the Franks, but retained their independence, and were governed by their own dukes. In 872 we find them defying the authority of the French kings. The line of dukes became extinct in 1054, and the duchy came into the power of the Dukes of Guienne.

Gas Engine is a motor the theory of whose working is closely connected with that of the steam-engine, but with a motive power supplied directly from the combustion of coal-gas or other similar gaseous fuel. The first successful gas-engine was brought out in 1860 by M. Lenoir, though practical application of the idea dates as far back as 1823. This engine used about 95 cubic feet of gas per horse-power per hour; an efficient gas-engine will now supply one horse-power per hour, with 15 cubic feet of coal-gas, or about 75

cubic feet of Dowson gas, whose combustion value is only about one-fifth of that of coal-gas. The general working of an ordinary gas-engine is as follows:—A piston works backwards and forwards in a cast-iron cylinder. At the beginning of a stroke the piston moves forwards and draws in a supply of gas and air combined in proper proportions for complete combustion. The mixture is ignited by some special contrivance that will not involve any escape into the outer air; explosion ensues, and the temperature rises rapidly to about $3,000^{\circ}$ C. The pressure undergoes a corresponding increase of from 180 to 200 lbs. per square inch, and the piston is thrust forward. The engine is single-acting, that is to say, explosions are only made to

temperature, both expressed in degrees Centigrade. With the ordinary modern ranges of temperature in a steam-engine t_2 rarely exceeds 195° C., and t_1 is about 45° C. This gives a maximum efficiency of .32, which means that only 32 per cent. of the heat supplied to the steam can be utilised in doing actual work. The combined efficiency of furnace, boiler, and engine in actual practice seldom exceeds 12 per cent. in large engines, and 4 per cent. in small ones.

With the internal-combustion engine, however, of which the gas-engine is the best-known representative, the whole energy of combustion is in the gas itself; the furnace is not a separate construction, and loss of heat is thereby prevented. A



SECTION OF OTTO GAS-ENGINE.

p, Piston ; c, cylinder ; ss, slide ; g, tube ; t, main gas-supply pipe ; j, special valve ; f, tube in cylinder ; w, water-jacket ; r, lever ; e, exhaust port ; v, rotating cam ; l, shaft ; k and m, connecting-rod ; n, parallel guides

take place on one side of the piston—the return stroke of the piston being effected not by a return thrust of high-pressure gas, but by the inertia of the moving parts, which carries the piston back to its original position. It is connected by means of a piston-rod and connecting-rod of the ordinary kind to a crank, and a reciprocating motion of piston is rendered capable of producing a rotatory motion of the shaft to which the crank is connected. A fly-wheel is fixed on the crank-shaft, and stores up enough energy in the forward stroke of the engine to carry the piston back in the backward stroke, and to regulate the supply of energy that is drawn from the engine. The temperatures attained in the cylinder are so high that the parts in contact with the burning gas would be rapidly burnt away but for the special provision of a *water-jacket* to the cylinder. This is a hollow casing through which cold water constantly circulates; the water draws off heat continually, and so prevents the attainment of too high a temperature of the cast-iron cylinder. The objection to the *water-jacket* is that it necessarily involves great loss of heat, which is abstracted without doing any useful work. Before entering on the fuller detail of a modern gas-engine, it may be remarked that the efficiency of such motors is much greater than that of a steam-engine. The maximum efficiency that is theoretically obtainable with a heat-engine is measured by the fraction $\frac{t_2 - t_1}{273 + t_3}$, where t_2 is the highest temperature employed with the working material and t_1 its lowest

temperature of $1,600^{\circ}$ C. may be regarded as the maximum available, and as the gas is passed into the exhaust at a temperature of about 400° C., this may be regarded as the minimum. These numbers applied in the above efficiency formula give 64 per cent. as the highest possible efficiency available with these given temperatures. In actual practice, taking into account the various losses, about 23 per cent. is usefully employed in doing work. Low as this is, it compares favourably with the results obtained with the steam-engine.

The accompanying sketch represents a diagrammatic section of the ordinary Otto gas-engine, which is one of the best-known modern engines. An explosion can only occur once in two revolutions of the crank-shaft; there are thus four strokes to each firing. Taking the first of these to start the cycle of operations, the heavy piston *p* starts moving to the left from the dotted line shown in the cast-iron cylinder *c*. The slide *ss* is during this stroke so placed that air is drawn into the cylinder from the tube *g* at the same time that gas is drawn in from the main gas-supply pipe *t*. Both air and gas pass in by the special valve *j*, which during this process connects both *g* and *t* with the tube *f* in the cylinder. During the return stroke the air and gas supplies are cut off from the cylinder by motion of the slide, and the enclosed mixture suffers a certain amount of compression, a process that it is very desirable to introduce before combustion. At the beginning of the third stroke a small amount of gas and air, that has been enclosed in the slide, is ignited by a flame at *k*

and conducted to *f*. It immediately starts the combustion in the cylinder; the temperature and pressure rapidly rise, the latter having an average value of about 660 lbs. per square inch during the first fifth of a second of combustion. After this, the pressure falls during the remainder of the stroke, though it must not be supposed that the combustion is completely over in that short interval of time. Much heat is taken away by the water-jacket *w*, which is to protect the lining of the cylinder from being burnt away by the intense heat. Towards the close of this third stroke the lever *r* is made to open the exhaust port *e* by means of a rotating cam *r* on the shaft *l*, and the hot gases pass away to the exhaust. The fourth stroke, which completes the cycle and brings the piston back to its original position, simply drives the gaseous products of combustion through the exhaust pipe. This is closed at the end of the stroke, so that a new supply may be drawn in. The same shaft *l* regulates the motion of the slide by means of the small connecting-rod *k*. The shaft is itself rotated by bevel-gearing that connects it with the crank-shaft of the engine. The cross-head of the piston-rod runs in parallel guides *n n*, and is joined up with the main crank by the connecting-rod *m* in the usual way.

Gas Heating. Complete burning of a combustible gas affords a certain amount of heat, which may be usefully employed for various purposes. In recent times the heat obtained by the combustion of coal-gas has been utilised in many ways. For domestic use the gas has been introduced into specially-constructed grates and there burnt by means of suitable burners, so that their heat may be given to blocks of asbestos, to a mixture of asbestos and coke, or to certain other similar materials, which become incandescent and radiate the heat outwards. This prevents the heat passing by convection directly up the flue or chimney; the obnoxious products of combustion pass up the flue, but a fair percentage of the heat is diverted into the room. For cooking purposes coal-gas is extensively used. Special gas-ranges are now designed, by means of which hot gas-flames may be produced by more complete combustion of the gas than obtains with the ordinary gas-flame employed in illumination. The heat thus produced is localised in that region where it is most wanted, such as, for instance, immediately below a kettle or saucepan placed in position on the grate, and the boiling of water or other such culinary operation rapidly ensues. With regard to the special purpose just mentioned, that of the production of boiling water, various patents have been brought out, depending upon the local application of heat obtained from gas. Water may be rapidly heated by passing through thin metal tubes or over thin plates, the other side of which is subjected to the heat of the gas-flame. This is very useful for the preparation of warm baths and the like.

In engineering and various arts coal-gas and other similar products have been in extensive use for some years. In the gas-engine (q.v.) the combination of coal-gas with a suitable amount of air is made to

produce an explosion in a cylinder, to cause a rapid increase in the temperature, and a consequent increase in pressure of the gaseous mixture; and the energy thus developed is directed so as to produce a reciprocating motion of a piston, and by suitable mechanism a rotatory motion of shafting and wheel-gearing. Special combustible gases, known as *producer-gas*, *water-gas*, and *Dunson gas*, are obtained by passing limited supplies of air or of air and steam through incandescent coke. This fuel is fairly cheap, and is much utilised for heating retorts in coal-gas making, in metallurgical operations, in glass and pottery works, boiler-heating, and in gas-engines. In various parts of the earth, such as Baku, China, and specially in North America, natural gas issues from the ground, and is employed similarly. Some varieties of this natural gas are useful for illumination.

There can be no doubt that the great advantage of smokeless burning is possessed by gas-fuel, though certain disadvantages also attend its use.

Gaskell, ELIZABETH CLEGHORN (1810–1865), an English novelist, was born at Chelsea. Her early days were not very tranquil, and she was brought up by an aunt. At 15 she went to Stratford-on-Avon, and here she learnt Latin, French and Italian. In 1832 she married the Rev. W. Gaskell, an Unitarian minister at Manchester. In 1848 she published *Mary Barton*, which dealt with one phase of life from the worker's point of view. This was very well received, and brought her the acquaintance of Dickens, Carlyle, and Thackeray. She wrote in *Household Words*, and in the *Cornhill Magazine*. In 1853 appeared *Ruth*, and scattered fragments were gathered up into *Cranford*. In 1855 *North and South*, which presented the question of *Mary Barton* from another point of view, appeared in *Household Words*. In 1857 she wrote the *Life of Charlotte Brontë*, one of the most charming of biographies, though certain statements in it given on the authority of Miss Brontë brought Mrs. Gaskell into some annoyance. In 1863 appeared *Sylvia's Lovers*, and the idyllic *Cousin Phyllis*. Her last work, unfinished, *Wives and Daughters*, appeared in the *Cornhill Magazine*.

Gas Lighting is a method of illumination by means of the combustion of coal-gas (q.v.), which is prepared from coal by destructive distillation. Various investigations were made by scientific men concerning the combustible gases that issued from mines in the coal district as far back as 1640. In 1787 Lord Dundonald tried experiments at home on gaslight. In 1813 Westminster Bridge was lit by coal gas, and since then the adoption of this means of illumination has been extensive throughout civilised countries. In most important places in this country the gasworks have now become the property of the local authorities.

The best coal for the purpose is intermediate between anthracite and lignite, of the ordinary bituminous kind. But to prevent the formation of a residue of useless ash it is customary, when employing this kind of coal, to mix it with a certain proportion of harder coal that will give a residue of fairly good coke. The importance of choosing a mixture that

gives a good residue is due to the fact that the liquid and solid ingredients which remain after distillation are of considerable value. For example, a ton of good cannel coal distilled between 750° and 800° F. will yield 68 gallons of oil (from which are obtained 2 gallons of paraffin spirit, 22½ gallons of lamp oil, and 24 gallons of heavy oil and paraffin), 1,280 lbs. of coke, while it yields 1,400 cubic feet of gas. If the same be distilled for ordinary gas production in the usual way it yields 18½ gallons of coal-tar (from which are obtained 3 pints of benzol, 3 pints coal-tar naphtha, and 9 gallons of heavy oils) and 1,200 pounds of coke. The distillation must not be prolonged too far if the candle-power is to be a maximum.

The candle-power of the gas is estimated by means of a standard burner burning 5 cubic feet of coal-gas per hour. The burner is either a Sugg's London Argand No. 1, or a standard Steatite Batwing burner. The light is compared with a standard candle (which is a sperm candle 6 to the pound, each burning 120 grains per hour), and it is found that ordinary gas possesses a candle power of 16 to 20 when estimated in the above manner. Better gas can be made, giving a power of 25 to 30 candles.

The general processes for the perfection of the gas when first distilled are given in the article on coal-gas. From the purifier the gas passes to a meter for measuring the quantity of gas manufactured, then through various pressure gauges and recorders, and on through a governor which regulates the flow. Finally it passes into the gas-holder, which is an inverted hollow cylinder of wrought-iron held over water that is contained in a cylindrical tank of stone, brick, concrete, or metal. The tank is usually below ground for convenience. As gas passes into the holder the cylinder rises. It is enabled to rise without difficulty by means of counterweights and vertical guides. The counterweights very nearly balance the weight of the vessel, which therefore only exerts a slight fraction of its weight upon the enclosed gas. Nevertheless the slight pressure of the gas which enters the meter must be sufficient to raise the cylinder. Thus the holders act as reservoirs to supply sufficient gas when the demand is great and store it up when the demand is slight. They are usually made large enough to contain a 24 hours' maximum supply. They also serve to equalise the pressure in the mains. These mains are of cast iron, the joints of the various sections being carefully rendered gas-tight by caulking or by the use of white- and red-lead, indiarubber, or rust cement. Branches pass from the mains to the consumers, each of whom is supplied with a meter to measure the amount consumed.

Gas-meters are of two kinds, dry and wet. The *dry meter* is an arrangement by which the pressure of gas sends forward a piston or diaphragm first one way along a cylinder and then the other way. The gas on one side of the piston when the cylinder is full is allowed to pass on for consumption, and the piston then returns by pressure of gas on the other side. As each stroke of the piston is made a lever is moved which records the stroke

and so measures the quantity of gas passed. The *net meter* is rather complicated in construction. It consists of a small inverted cylinder containing 4 spiral chambers. The cylinder is mounted over water on a vertical axis, and as gas passes into one of the spiral chambers the cylinder is slowly rotated. When one chamber is full, the succeeding one is rotated into a convenient position to be filled by gas, and the gas in the first is allowed to pass on by an orifice which discloses itself at the top. The amount of rotation measures the amount of gas supplied, and is recorded on a dial.

Of gas-burners there have been many types invented. The batwing burner has a slit across the top, and the fish-tail type has two passages meeting at an angle with each other, causing the flame to spread out into a thin sheet. The Argand burner has a hollow ring of flame formed by a number of holes arranged in a circle. The Argand is improved by having a porcelain cylinder in the middle of the flame; it keeps the temperature uniformly high, and also serves to emit light itself when incandescent. Ordinary gas may be improved by being passed through melted naphthaline, it thus taking up some of this heavy hydro-carbon. This is the ordinary albo-carbon principle. The average cost of ordinary gas burned in a fairly good burner with a lighting effect of 8 candles is about 1s. per candle per 1,000 hours. Wax candles cost about 3d. per candle per 1,000 hours. Electric arc lamps of 1,500 candle-power cost, on an average, 2½d. per candle per 1,000 hours; while electric incandescent lamps of 16 candle-power cost about 1s. 8d. per candle for the same time. Latterly, by the invention of Baron von Welsbach in the early eighties of a system of incandescent (q.v.) gas-lighting, the illuminating and penetrative power of house gas was greatly increased, and as a consequence the growing competition of the electric light, both in business and private houses, was combated. By means of a "stocking," made of ramie fibre (q.v.), woven into a conical tube and subsequently dipped into a mineral solution of thorium nitrate and cerium nitrate, the Baron was able, by using a special burner, to obtain a brilliant light of considerable candle-power at a consumption of gas far less than that through the ordinary burner. The incandescent gas-lighting system has practically superseded the old form of gas jet.

Gas Liquor. In the manufacture of coal-gas (q.v.) a large quantity of a liquid distillate is produced and collected in suitable receivers. This distillate consists of two parts, a *tarry* liquid [COAL-TAR] and an *aqueous*. The latter, which is known as *gas liquor* or *ammoniacal gas liquor*, is, ordinarily, a slightly yellow liquid with an ammoniacal and fetid smell. It contains small quantities of tarry matters and benzene compounds and a considerable amount of ammoniacal salts, chiefly the carbonate, and sulphide. To these the gas liquor owes its commercial value, and it is largely employed for the production of ammonia and its salts, being at present almost the sole manufacturing source of these compounds. To obtain them, steam is blown through the liquor, by which means some

of the ammonia salts are decomposed, and free ammonia mixed with steam passes off. Many manufacturers add lime also to the gas liquor to make the decomposition complete. The mixed steam and ammonia is then either (1) condensed, forming what is known as *concentrated gas liquor*, consisting chiefly of an impure solution of ammonia, or (2) is passed into sulphuric acid contained in lead chambers, by which means *ammonium sulphate* is produced and crystallises out. This is then either sold—being employed largely as a manure—or used further for the production of pure ammonia and the other salts of this substance.

Gasoline is the name given to some of the lighter and more volatile portions obtained in the distillation and purification of crude petroleum. It is a very volatile liquid with boiling-point varying from about 35° to 80° C., which consists mainly of a mixture of the hydrocarbons—*pentane* (C_5H_{12}), *hexane* (C_6H_{14}), and *heptane* (C_7H_{16}). It is also called "motor-spirit" in England from its use in providing power for motor vehicles. [PARAFFINS, PETROLEUM.]

Gaspé, a peninsula in the province of Quebec, Canada, in the Gulf of St. Lawrence, between the estuary of the St. Lawrence and the Bay of Chaleurs. The chief occupations are fishing and lumbering.

Gas Producers. In many metallurgical operations gaseous fuel is employed as a source of heat. In these cases the gas is usually manufactured by the distillation of coal-slack, etc., brought about by the combustion of part of the coal itself. The manufacture is carried on in what are known as *Producers*, many forms of which are in use—e.g. Siemens', Casson's, etc. They all consist of large chambers of fire-brick, or iron lined with fire-brick, provided with *hoppers* for the introduction of the coal, etc., in which the fuel is burned in an insufficient supply of air. A blast of steam is also usually blown through, which serves not only to increase the pressure of the gas and produce a draught, but also causes a greater quantity of gas to be formed. The products then pass into large iron tubes or culverts, leading usually direct to the furnace in which the gas is to be employed. Producer gases thus prepared consist chiefly of various *hydrocarbons*, resulting from the distillation of the coal, *carbon monoxide* (CO), resulting from the incomplete combustion, and *hydrogen* present owing to the decomposition of the steam. They are usually mixed with air and heated before admission into the furnace, as by these means a higher temperature is obtained.

Gassendi, PIERRE (1592-1655), a French philosopher, was born in Provence. He went to school at Digne, and then to Aix. He returned to Digne, where he lectured in theology. In 1617 he was ordained priest and appointed Professor of Philosophy at Aix. He was dissatisfied with the scholastic philosophy which passed under the name of Aristotelianism, and in 1624 expressed his views in *Exercitationes Paradoxicæ adversus Aristoteleos*. After travelling for some years, he was appointed in 1645 Professor

of Mathematics at the Collège Royal of Paris. He had a great regard for the philosophical system of Epicurus, and in 1647 wrote *De Vitâ, Mortibus, et Doctrinâ Epicuri* in eight books. After again travelling for his health, he returned to Paris in 1653, and wrote lives of Copernicus and Tycho Brahe. His great work, *Syntagma Philosophicum*, shows him to have been eclectic and by no means consistent in his eclecticism. He has been described as a philosophical man of letters and a literary philosopher. The theory of "primary and secondary qualities of matter" (i.e. that colours, smells, etc., are due to the action on our senses of the particles of matter, which in themselves are only extended, solid, and mobile), which has been important in the philosophy of the last two centuries, was reintroduced by him directly from Epicurus.

Gasteromycetes, the order or sub-class of the Basidiomycetes (q.v.) that possess *angiocarpous* or closed fructification. Their compound sporophores often reach a large size, some puff-balls exceeding a foot in diameter, and in almost all cases they are invested by a thickened membrane or *peridium*, which is often produced inwards so as to divide up the fungus into hymenial chambers. Among the chief forms are the *Lycoperdaceæ* or puff-balls, including *Geaster*, the earth-stars; and the *Phalloideæ* or stink-horns.

Gastralgia (Greek, *gaster*, the stomach, *algos*, pain), the term applied to the pain which is associated with certain morbid conditions of the stomach.

Gastreadæ. [GASTRULA.]

Gastric Fever, a term very loosely applied and practically superseded since the recognition of the disease of enteric or typhoid fever.

Gastric Juice. [DIGESTION.]

Gastritis, inflammation of the mucous membrane of the stomach.

Gastrochænidæ, a family of Lamellibranchs or bivalve molluscs. These animals are marine and live near the shore, where they burrow into mud or rocks. The bivalve shell is thin, and, in most species, soon ceases to grow; there is, however, an accessory shell secreted by the outer surface of the siphons; this forms a tube open at both ends. A familiar instance of this group is *Aspergillum* (q.v.).

Gastropoda, a class of Mollusca, including the common univalved forms, such as the whelks and winkle, those with numerous valves, such as the Chitons, as well as many, such as the slugs, in which the shell is rudimentary or absent. They belong to the group *Glossophora* (q.v.), as they possess a distinct head and are armed with a toothed tongue or radula. The main character by which they are separated from the other classes of *Glossophora* is the condition of the foot; this is normally simple in shape, and is median in position; it is flattened into a large sole, and as the animal crawls about on this, the name of *Gastropoda* (or belly-footed) has been given to the group. The foot may be divided by transverse constrictions into three divisions,

known as the pro-, meso-, and meta-podia. The metapodium may be expanded into a flat swimming paddle in the free-swimming forms, such as the Natantia (e.g., *Atlanta*, *Carinaria*). The metapodium also often bears a horny or calcareous plate, known as the operculum; by this the mouth of the shell is closed. This must not be confounded with the "epiphragm," or horny covering, secreted by many snails as a protection for the mouth during winter; most English snails form such an epiphragm, whereas there is only one (*Cyclotoma elegans*) with an operculum. The shell is the most important part of the skeleton in Gastropods, and is extremely varied in form. The simplest type is simply a low flat cone, covering the dorsal side of the animal as in the Limpet (*Patella*); this may be closed above as in *Patella*, or have an aperture at the summit of the cone as in *Fissurella*, the Keyhole Limpet. In the next form the cone elongates as in the long tubular shells of *Vermicularia* and its allies, once included among the worms; the elephant-tooth shell (*Dentalium*) is a similar cone, but it is not now included among the Gastropoda. In some of the *Vermicidae* the shell is coiled at one end; in other genera this coiling becomes more pronounced till the shell is a long compact spiral, as in *Cerithium* or *Turritella*, or a flat disc-shaped coil as in *Planorbis*; the former are usually coiled round a central solid rod (the columella), but this may be absent and a central cavity (the umbilicus) runs partially or wholly up the centre, as in the Wentle-traps (*Scalariidae*). The shell may, however, have been formed from the twisting of a short, broad tube, instead of a long cylindrical one, the last whorl of the resulting shell will then be large, and have a wide mouth, as in the whelks (*Buccinum*) or winkles (*Littorina*); in extreme cases, such as Venus' Ear-shell (*Haliotis*), the coil may be almost suppressed and hidden in the large, expanded saucer-like shell. In the family of the Chitons the shell consists of eight plates, each like an inverted V, placed in an overlapping series, which completely covers the back of the mollusc. In the slugs the shell may consist of a small internal plate, or it may be represented by a few spicules, as in *Ariom*, or it may be quite absent. The head is always distinct, and it is often extended into a rostrum, which may be a retractile proboscis (as in the whelk) or non-retractile as in most other Azygobranchs. The heart usually consists of but one auricle and one ventricle, but a few forms, such as *Haliotis* and *Fissurella*, have two auricles. The nervous system is on the normal molluscan plan of three pairs of ganglia; the extent to which the commissures which connect these have been involved in the torsion to which the dorsal hump has been subjected in most of the Gastropods with coiled shells, is used very largely as the basis of the classification of the group.

As regards their mode of life, they are mostly marine, and live creeping over rocks or sea-weed; those in which the mouth is "entire" live on algae and other vegetable forms of life, whereas those in which the mouth is notched by a groove (e.g. the whelks) are carnivorous; these bore through the shells of other molluscs with their long, armed tongue, and then suck out the animal with their

proboscis. Others, such as *Carinaria*, swim about by the posterior expansion of the foot known as the metapodium; a few are parasitic, such as *Entocacha mirabilis*, which lives in Holothurians. Others live in fresh-waters, such as *Paludina*, *Limnea*, and others of our common pond and river snails. One group—the Pulmonata—live on land, and are distributed widely throughout the world.

The range in time of the class is very extensive. The first representatives occur in the Cambrian; *Murchisonia* and *Loxonema* are common Paleozoic (q.v.) genera. It first becomes of great importance in the Trias and Jurassic, as in the St. Cassian beds of the Tyrol and the Great Oolite of our country. In the Cainozoic (q.v.) era they are to geologists the most important of all fossils.

The most recent and generally accepted classification of the class is as follows:—

Group I.—GASTROPODA ISOLEURA.

Elongated forms retaining their primitive bilateral symmetry, and with a pair of straight nerve cords, running the full length of the body.*

- (1) Polyplocephora, e.g. the Chitons.
- (2) Neomeniidae.
- (3) Chatoderma.

Group II.—GASTROPODA ANISOLEURA.

The primitive bilateral symmetry retained in the head and foot, but lost in the visceral mass.

I. STRIPTONEURA.—The nerve loop to the viscera twisted. Sexes separate.

- (1) Ctenidiobranchiata—
a. Ctenidiobranchiata, e.g. *Haliotis*, *Fissurella*, etc.
b. Phyllidiobranchiata, e.g. *Patella* (Limpet).
- (2) Azygobranchia—
a. Reptantia, e.g. *Trochus*, *Patella* (Pond Snails), *Buccinum* (Whelks), etc.
b. Natantia, *Heteropoda* (q.v.).

II. EUTHYNNEURA.—The nerve loop not twisted; hermaphrodite.

- (1) Opisthobranchia—
a. Palliata, e.g. *Bulla*, *Aplysia* (Sea Hare).
b. Non-palliata (Sea Slugs), e.g. *Euolis*, *Doris*.
- (2) Pulmonata—
a. Basommatophora, e.g. *Planorbis*, *Limnea* (Pond Snails).
b. Stylommatophora, e.g. *Helix* (Land Snails), *Limax* (Slugs).

Gastrostomy (Greek *gaster*, the stomach, and *stoma*, a mouth), the operation of introducing a tube into the stomach for purposes of artificial feeding. This proceeding is necessitated when the oesophagus or gullet is rendered impassable in certain diseased conditions.

Gastrotomy (Greek *gaster*, and *tome*, a cutting), the operation of opening the peritoneal cavity—i.e. the cavity of the abdomen.

Gastrula, the name of the stage in development which is passed through by all Metazoa or multicellular animals. It consists of a simple spherical or egg-shaped sac, composed of a double layer of cells with an opening (the blastopore) at one end. In one group of animals (the Gastreidea) the adult condition is not more advanced than this. [See BLASTOSPHERE for the general sketch of the early development.]

* The most important characters only are mentioned.

Gasvolumeter, a form of apparatus devised by Professor Lunge, which is of great use for the speedy estimation of many substances. In all cases this is effected by the measurement of the volume of gas evolved by some reaction, the advantage of the instrument over the ordinary *nitrometer* (q.v.), of which it is a modified form, being that all calculations for varying temperatures and barometric pressure are obviated.

Gatchina, a town in the government of St. Petersburg in the district of Tsarskoselo, Russia. It is 29 miles W. of the capital, in a wooded and marshy flat near the White and Black Lakes, and is approached by the Warsaw line of railway. Here, in 1770, a palace was founded by Prince Orloff, the designs being supplied by Rinaldi. The present Tsar has resided therein during the greater portion of his reign, surrounded by a cordon of troops, and a cloud of police spies. The town also contains four Greek churches, a Protestant chapel, a founding asylum, a military orphanage, a hospital, and a porcelain factory. In one of the churches are relics brought from Rhodes to Malta by L'Isle Adam, Grand-Master of the Knights Templar.

Gates, HORATIO, born at Maldon, Essex, in 1728, entered the English army, and, having accompanied Braddock in his disastrous American expedition, settled in Virginia in 1763. On the outbreak of the War of Independence he was appointed adjutant-general, and subsequently commanded the colonial forces on Lake Champlain. In 1776 he defeated Burgoyne, and received his surrender at Saratoga, but four years later was routed by Cornwallis at Camden, South Carolina. His conduct formed the subject of an inquiry, which resulted in his complete exoneration. After manumitting his slaves, he left Virginia in 1800, and went to live in New York, where he became a member of the legislature, and died in 1806.

Gateshead, a parliamentary and municipal borough in the county of Durham, on the right bank of the Tyne, opposite Newcastle, with which it is connected by four bridges. It was originally a Roman outwork, and grew into a borough before the 11th century. For centuries it was governed by the Bishops of Durham, but in 1695 it received the privilege of electing two stewards to manage its affairs, and in 1826 it became a municipality. It returns one member to Parliament. The town consists of two principal streets nearly parallel, and from these diverge many others. They are fairly built, and a great fire in 1854 was followed by considerable improvements. Iron-works, foundries, locomotive-factories, ship-building yards, glass-works, chemical and soap manufactories and tanneries provide occupation for a large population. The North-Eastern Railway has its chief dépôt here, and in the neighbourhood are large coal-mines, and stone-quarries. There are a public park, an ancient cruciform parish church, and a grammar school. Pop. (1909), 129,000.

Gath (Heb. "wine-press"), the name of several places in Palestine, the most famous of which was one of the five Philistine cities. According to

Scripture (1 Sam. xvii. 2, 52), Gath must have been near the valley of Elah, about 32 miles W. of Jerusalem.

Gatling, RICHARD JORDAN, M.D., the son of a mechanical engineer, was born in North Carolina in 1818. His early years were passed in assisting his father; but in 1844 he began a course of medical study. He does not appear, however, to have practised his profession, and in 1849 he settled at Indianapolis, where he engaged in railway enterprises and land speculations, bringing out several mechanical inventions. In 1861 he perfected the revolving gun with which his name is associated. The inventor set up a factory, and embarked on other experiments which have resulted in an improved method of casting large ordnance, in the building of several torpedo-boats, and in a pneumatic gun, for the discharge of modern explosive shells. He died in 1903.

Gauchos, the collective name of the semi-nomad, Hispano-American inhabitants of the pampas, or grassy steppe lands of the Argentine Republic. They are essentially a pastoral people, who are said to take their name from the Araucanian word *gachu*, meaning "friend," "comrade," and used as a form of courteous salutation between strangers meeting in the wilderness; but the etymology is doubtful. The Gauchos live entirely in the saddle, and, being excellent horsemen skilled in the use of the lasso and bolas, are employed, like the North American "cowboys," to look after the half-wild herds of the Argentine stock-breeders. They are excessively polite and hospitable, and Darwin assures us that he never met with "even one instance of rudeness or inhospitality" from any of them (*Voyage Round the World*, ch. viii.) All speak Spanish exclusively, and, in fact, are of nearly pure Spanish descent.

Gaudemus, the first word of a popular German students' song, written in dog-Latin. The first line is *Gaudemus igitur juvenes dum sumus* ("So let us be merry while we are young"). It was first published in 1776.

Gauge is a measuring instrument. A *pressure gauge* is an instrument for measuring the pressure of a fluid such as the steam in a boiler. The most generally adopted pressure gauge is that known as Bourdon's (q.v.), which admits the fluid into a curved hollow tube of special section, closed at the extreme end. The internal pressure tends to straighten out the tube, which is fixed at the open end so that the closed end is free to move under the action of the internal force. Its motion is communicated to a pointer on a graduated dial and the pressure is thus estimated. Similar in principle is the ordinary *vacuum gauge*, to measure the degree of vacuum produced in steam-engine condensers, or in air-pump receivers. In this case the hollow tube is connected with the exhausted space; and the external pressure being in this case greater than the internal, the tube will exhibit a reverse action and become more curved. The recording part of the instrument is the same as before.

The *Wire Gauge* (q.v.) is for the purpose of

determining the diameter of wires, and is of much importance in modern electrical work. The simplest form consists of a plate of steel in which slits are cut of various widths. Each slit is numbered, and the diameter of the given wire is expressed by the number of that special slit into which it exactly fits. There are, unfortunately, various systems of numbering, the Birmingham wire gauge (generally termed B.W.G.) being the most widely adopted. It would be much more convenient in many ways to give the width of each slit in decimal parts of an inch.

Wind Gauge is an instrument for measuring the intensity of wind-pressure, and is generally of the windmill type, the amount of rotation of a small windmill of special construction giving the average intensity of the wind during a known interval. [ANEMOMETER.]

Rain Gauge (q.v.) measures the number of inches of rainfall in a given period of time, by collecting the rain in a graduated vessel, taking care to prevent loss by evaporation or other causes.

Gauge-notch in hydraulics is an arrangement for measuring the quantity of water flowing past any section of a small stream. It is a V-shaped or rectangular notch cut out of a board which is fixed across the channel in such a way that the water has to flow through the notch. It must have sharp edges to give accurate results, which are calculated from the dimensions of the notch and the head of water behind it.

The word *gauging* is employed to denote the measurement of the capacity of casks.

Gauge in railway engineering denotes the distance apart of the rails, measured from centre to centre. The ordinary gauge in England is 4 feet 8½ inches; the old Scottish gauge is 5 feet 6 inches; the Irish gauges 6 feet 2 inches, and 5 feet 3 inches; and the *broad gauge* employed until recently on the Great Western Railway was 7 feet. A narrow gauge railway of 1 foot 11½ inches is used for passenger and slate traffic at Ffestiniog in North Wales, and gauges of two and three feet, and one metre, are common, on "light railways," in various parts of the world. [RAILWAYS.]

Gault, a provincial name for a blue clay applied in English geology to the Albian or lower division of the Upper Cretaceous rocks. As developed in England, it is generally a stiff blue marine clay, sometimes slightly calcareous, sandy, or micaceous, containing abundant nodules of iron-pyrites, generally a layer of phosphatic nodules near its base, and a large number and variety of pyritised or phosphatised fossils. It often overlaps the subjacent rocks unconformably and varies from 100 to 150 or even 200 feet in thickness. In the Isle of Wight it is termed "blue slipper," from the tendency of overlying porous strata to slide over it, producing landslips (q.v.). The Gault may be examined about Barnwell in Cambridgeshire, at various points in the Weald, and especially near Folkestone, where it has been subdivided into eleven paleontological zones (q.v.), of which seven belong to the Lower Gault or *Hamites rotundus* section, and four to the Upper Gault or *Inoceramus*

sulcatus section. Of 240 fossils, 124 are peculiar to the Lower, 59 to the Upper, and only 39 common to both. Gastropods and bivalves abound in the Lower, with such cephalopods as *Hamites*, *Crioceras*, *Ancylocras*, etc., and several species of small crabs; whilst *Sophites* occurs in the Upper, and numerous ammonites throughout both divisions, often retaining their nacreous or pearly lustre. *Dentalium* and *Belemnites* are also common, and fir-cones indicate the proximity of land. The Gault forms a stiff soil mostly in pasture and known as "black land." It bears fine trees, especially oaks, and it is dug for brick-making.

Gaur, GOUR (*Bos gaurus*), a large and very fierce wild ox, with short, strong horns, and without a dewlap. It is found in small herds in the table-lands of South Berar. The only one hitherto brought alive to Europe died in the Zoological Gardens, Regent's Park, in 1892.

Gaur, or GOUR, a deserted city in Bengal, situated some 4 miles S. of Malda, between the Ganges and the Mahananda rivers. The name, originally Gauda, and signifying "sugar country," was applied to a large area. According to Hindu tradition, Gaur was the seat of a long succession of dynasties, and was known as Lakhnati. At the end of the 12th century it fell into Mohammedan hands, and resumed its ancient appellation, becoming the capital of the quasi-independent kings of Bengal. About the close of the 16th century they came to an end, a pestilence devastated the place, and it dropped out of history, though it would appear to have had some population as late as 1750.

Gaurian, a general name for the Neo-Sanskritic languages of India, proposed by Professor Hoernle and accepted by Bishop Caldwell and other recent philologists. The five chief languages of the Gaurian group are Hindi, including Hindustani; Bengali; Uriya of Orissa; Gujarati; and Panjabî; and these are the *Panoh Gaura*, or "five Gaurian tongues" of the natives. They are all derived from Sanskrit through intermediate Prakritic (vulgar) idioms by analytical processes and phonetic changes analogous to those by which the Romance (Neo-Latin) tongues flow from Latin. The oldest extant monument of a Gaurian language is the *Chand Bardai*, a Hindi poem by Prithvirâja Raso, who flourished in the 12th century. (E. L. Brandreth, *The Gaurian compared with the Romanee Languages*, in *Jour. Asiatic Soc.*, August, 1879.)

Gauss, KARL FRIEDRICH, was born in Brunswick in 1777, and devoted himself to astronomy. He won the Lalinde medal of the French Institute for calculating the elements of the orbits of Ceres and Pallas, and in 1807 was appointed director of the Göttingen observatory. In 1821 he undertook the triangulation of Hanover. He next directed his attention to magnetic phenomena, created in 1833 a magnetic observatory at Göttingen, and an association which extended over Europe, and invented most of the instruments now in use for magnetic investigations. His works, which cover the whole field of pure and applied mathematics,

have been collected in seven volumes. He died in 1855, and his centenary was celebrated at Brunswick in 1877.

Gautier, THÉOPHILE, was born at Tarbes in 1811. He passed from the public school of that town to the Collège Charlemagne in Paris, but won no distinctions. His first ambition was to become a painter, and it was probably under the influence of Gérard, Corot, and Borel, quite as much as of Gérard de Nerval, that he rushed into romanticism with the fervour of a neophyte. He was not long in discovering the real bent of his genius, and in 1830, after a few early efforts, brought out his first poem, *Albertus*. The *Comédie de la Mort* followed in 1832; but Gautier, who had meanwhile served Balzac as secretary, gradually found himself drawn more and more closely to prose as his best mode of utterance. A number of short stories were written by him about 1833, but these passed almost unnoticed until in 1835 *Mademoiselle de Maupin* marked its author as one of the greatest masters of French style. *Fortunio, Jettatura, La Morte Amoureuse, Une Larme du Diable, Militona, Spirite, Le Roman de la Momie, et Le Capitaine Fracasse*, are the best examples of his skill in fiction. He was, moreover, a great traveller within civilised limits, and his *Constantinople, Voyage en Russie, Voyage en Espagne, Caprices et Zigzags*, if not highly original, clothe the information of the guide-book in a very agreeable garb. His criticisms on art and literature, contributed chiefly to *La Presse* and *Le Moniteur*, deserve more attention than can be given them here, and will repay careful study. He returned now and again to verse, and the *Émaux et Camées*, first published in 1840, and reprinted with additions in 1872, contain some of the choicest lyrics that France can boast. *La Ménagerie Intime* and *Tableaux de Siège* appeared just before his death in the latter year.

Gauze, a thin transparent fabric of silk, or silk and cotton. It is manufactured in large quantities in France and Switzerland, and in Great Britain at Glasgow, Paisley, and elsewhere. The threads of the warp are crossed between every thread of the weft, so as to form a series of loops. In this way each thread is kept in its place, while at the same time the texture is more loose and open than would otherwise be possible.

Gavarni, a pseudonym adopted by SULPICE PAUL GUILLAUME CHEVALIER, the famous French caricaturist, who was born in Paris of very humble parents in 1801. Starting in life as a workman in an engineer's factory, he cultivated during leisure moments his taste for figure-drawing, but it was not till his thirty-fourth year that he managed to get some of his sketches published by a journal of fashions. His talents soon became appreciated, and he was appointed editor of *Les Gens du Monde*, from which he passed to *Le Charivari* as a satirist of the men, women, and manners of contemporary France. His pencil found material in every social stratum. He was in great demand, too, as an illustrator of books, and *Le Juif Errant, Les Contes de Hoffmann, Les Physiologies* of Aubert, and an edition of Balzac's novels are among his chief efforts

in that line. Gavarni was also a man of scientific tastes, and before his death in 1866 sent several papers to the Académie des Sciences.

Gavazzi, FATHER ALESSANDRO, was born at Bologna in 1809, and, entering the Romish priesthood, joined the order of Barnabites, amongst whom he soon acquired reputation as a preacher. He was appointed Professor of Rhetoric at Naples, and on the accession of Pius IX. to the tiara in 1846, he actively supported the Pope's Liberal policy, and served as chaplain-general to the Roman legion sent to aid the Milanese. When the views of the Holy Father changed, he cast off his allegiance, and joined in the revolution of 1848. The French occupation of Rome compelled him to seek a refuge in England, and for some years he figured as an Anti-Papacy lecturer in Great Britain and the United States. He also published his *Memoirs* and some of his *Orations*. In 1860 he took part with Garibaldi in his invasion of Sicily, and did not return to England until 1876, when he again lectured for the benefit of the Free Italian Church. He died in 1889.

Gavelkind, the common custom of the descent of land in Kent, almost the whole of which county was formerly subject to this tenure. Gavelkind before A.D. 1066 was the general custom of the realm; the feudal custom of primogeniture superseded it. It was retained in Kent, because, according to historical legend, the Kentish men surrounded William the Conqueror with a moving wood of boughs just after the slaughter at Hastings, and for that service obtained a confirmation of their ancient rights. The distinguishing properties of gavelkind are principally the following:—

1. The tenant is of age sufficient to alienate his estate by feoffment at the age of 15 years. [FEOFFMENT.]

2. The estate did not escheat in case of attainder for felony, the maxim being "the father to the bough, the son to the plough." [ATTAINER.]

3. In most places where the tenure is gavelkind, the tenant always enjoyed the power of disposing of his lands and tenements by will.

4. The lands descend not to the eldest, youngest, or any one son only, but to all the sons together, which was anciently the usual course of descent all over England. [DESCENT.]

5. The wife is dowable of one-half instead of one-third of the lands, so long as she remains chaste and unmarried. [DOWER.]

6. The husband will be tenant by the courtesy, whether there be issue born or not, but only of one-half so long as he remains unmarried. [COURTESY, TENANT BY.]

These, among other properties, distinguish this, to us nowadays, remarkable tenure. By a statute of Henry VIII., certain lands in Kent are directed to be descendible for the future like other lands. This custom also prevails in some other parts of the country and in some copyhold manors. [COMMON LAW.]

Gavial. [Gharial.]

Gavotte, a dance resembling the minuet, introduced from France towards the end of the 17th century. In the course of 80 or 100 years it

became obsolete, and the name is now confined to the music intended to accompany it. This consists of 8 bars twice repeated, and opening with an up-beat. The time is *alla breve*.

Gay, JOHN, was born of a good family at Frithelstock, Devonshire, in 1688, but, losing his father early, was apprenticed to a silk-mercer in London. He disliked business, and abandoned it for literature. In 1710 appeared his first poem in serio-comic style, the subject being *Wine*. Two years later the Duchess of Monmouth engaged him as secretary, and in 1713 he published *Rural Sports*, which was dedicated to Pope, a life-long friend. *The Fan*, *The Wife of Bath*, a comedy, and *The Shepherd's Week* were produced in quick succession. In 1714 he held for a few months the post of secretary to Lord Clarendon, then ambassador at Hanover, but this was his last bit of official patronage. The *Trivia*, a very clever sketch of the London life of his day, added much to his reputation in 1716, but *Three Hours after Marriage*, a comedy in which Pope and Arbuthnot both lent a hand, proved an utter failure. A subscription for his collected poems and a gift of South Sea Stock from Secretary Craggs might have placed him beyond the reach of want, but he embarked in the prevailing speculations and was reduced to beggary. An illness ensued, from which he was rescued by the kindness of patrons and friends. In 1724 he brought out *The Captives*, a moderately successful tragedy, and in 1720 came the first volume of his celebrated *Fables*. *The Beggar's Opera* in 1727 proved a great hit, and replenished the author's exchequer, which was further swelled by the proceeds of another subscription, got up by the Duke and Duchess of Queensberry, whose house sheltered the poet till his death in 1732. His grave is in Westminster Abbey. The second instalment of his *Fables*, the *Distrest Wife*, and the *Rehearsal at Gotham* were published posthumously. *Polly*, a satirical opera, incurred the veto of the Lord Chamberlain; but, being printed, was one of Gay's most profitable ventures.

Gaya, a district and its capital in the Patna division of Bengal, British India. The former has an area of 4,718 square miles, and lies between Patna N., Monghyr E., Hazaribagh S., and Shahabad W. The southern portion is hilly and woody, but towards the north the land slopes into a level and fertile plain, producing rice, wheat, oil-seeds, cotton, opium, indigo, and sugar. Saltpetre and timber are also exported. The climate is healthy, but subject to droughts. The Son is the chief river, and is navigable for small craft; the Pimpun, the Phalgu, and the Jumna are other streams. The population is chiefly Hindu, and the district is full of holy places, which maintain a lazy crew of priests called *Gayawals*. At Buddh Gaya the founder of Buddhism, Sakya Sinha, passed his period of contemplation under a fig-tree, and another centre of pilgrimages is found on the Baraba Hills. The town of Gaya is on the Phalgu, and is divided into two parts, one of which serves for the residence of merchants and strangers, whilst the other is occupied by the priests.

Gayal (*Bibos frontalis*), an Indian wild ox from the hill region east of the Brahmapootra. It is about the size of our English cattle, and there is a domesticated race.

Gay-Lussac, JOSEPH LOUIS, born at St. Léonard, Haute Vienne, France, in 1778, his father being a high legal official, was sent to the Ecole Polytechnique, where he showed so great an aptitude for physics and chemistry that Berthollet chose him to be his assistant. His first labours were directed to experiments on the dilatation of gases, and in 1804 he undertook two balloon ascents in order to obtain data as to terrestrial magnetism and the chemical constituents of the air. In 1805 and 1806 he accompanied A. von Humboldt in a tour through Switzerland, Italy, and Germany, returning to Paris just in time to secure his election to a vacancy in the Académie des Sciences. He next engaged with Thénard in investigating the properties of potassium, sodium, and boron, his discoveries being parallel to those of Davy, and in 1809 a similar honourable rivalry sprang up as regards the analysis of oxy-muriatic acid gas. In the same year he published the result of his observations as to the laws governing the combination of gases and the ratio borne by the volume of gaseous compounds to that of their primary elements. In 1811 appeared his *Récherches Physico-Chimiques*. This was followed by his important discoveries as to the constitution of hydrocyanic acid and the characteristics of iodine. The last part of his career was devoted to practical inquiries into such subjects as the bleaching action of chlorine, the assaying of precious metals, the processes of fermentation, and the manufacture of gunpowder. He lectured assiduously in various schools, and published his *Cours de Physique* and *Cours de Chimie*, working also with a number of private pupils, the most illustrious of whom was Liebig. He was made a peer of France in 1839. In lucidity, accuracy, and honesty, Gay-Lussac is surpassed by no other investigator. He died in 1850.

Gay-Lussac's Law, in *Heat*, is that the proportional increase in the volume of a gas under constant pressure from its volume at 0°C . is a constant multiple of its temperature. This multiple is known as the *coefficient of expansion* of the gas for constant pressure, and it is found by experiment to be about $\frac{1}{273}$ or $'00367$. The diminution in volume when cooled below 0°C . follows the same law for some time; if the law be supposed to hold good down to a temperature of -273°C . the volume must be regarded as zero.

Gaza (mod. *Ghazeh*, Heb. *Azzah*, "strong"), an ancient Philistine city, 3 miles from the sea, and close to the S. boundary of the Holy Land, 50 miles S.W. of Jerusalem. It served as a barrier against attack from Egypt, and was frequently changing hands in the struggles between the Jews and their neighbours. Thus it happened that Samson was caught here, and released himself by carrying off the gates, and here, too, was the scene of his death. A tomb is still pointed out as his resting-place, but is, no doubt, apocryphal. The

modern town stands on an isolated hill, and has olive-gardens, palms, and some corn-fields in its neighbourhood. There are good bazaars, a large mosque built of ancient materials, and some pottery-works. Hashem, Mahomet's father, is buried here. The old port Limena Gaza, now El Mineh, is useless. Gaza was for many centuries the seat of a bishopric, and has a chariot-course and other traces of Graeco-Latin civilisation.

Gazelle, any antelope of the genus *Gazella*, with seventeen species, ranging from North Africa eastwards to India, and having one representative in South Africa. They are small, lithe, and very active; the horns, which are smaller in the female, are black, strong, and lyrate; the fur is short and close-pressed, and there is usually a tuft of hair at the knee. The true gazelle (*Gazella dorcas*) ranges from North Africa into Persia, where also the larger form (*G. subgutturosa*) is found. It stands a little less than two feet high, and the body hair is rather coarse and of a pale fawn colour above, while the under surface is white. This species is often kept as a pet in the East, and references to it and to the beauty of its eyes are common in poetry. Authorities differ as to their habits: it is usually said that they live in large troops, and tales are told of the males forming a circle, with the does and fawns in the middle, and presenting a serried mass of horns to attacking lions or leopards. Blanford says that the true gazelle and Bennett's, or the Indian gazelle (*G. bennetti*) are generally met with singly, or in groups of from two to five, which, if correct, disposes of the circle story. Other species are the Arabian or Ariel gazelle (*G. ariet*), the Abyssinian (*G. scemmeringii*), the Korin (*G. rufifrons*), Grant's, or the East African gazelle (*G. granti*), and Speke's gazelle (*G. spekii*).

Gazetteer, a geographical or topographical dictionary, in which the names of places are arranged in alphabetical order, and statistical and other information is given concerning each. The word originally meant a writer in gazettes or newspapers—a sense which it retained in the 18th century. Its present meaning is due to the title of Laurence Echard's geographical dictionary of Europe, *The Gazetteer's or Newsman's Interpreter* (1703). In 1704 a second part was published, dealing with Asia, Africa, and America, in which the work is described as *The Gazetteer*.

Gean-tree. [CHERRY.]

Geary, SIR FRANCIS, BART., naval officer, born in 1709, became a captain in 1742. He was distinguished for the number, size, and value of his prizes; but he took part in no operation of importance until after his promotion to be rear-admiral in 1759. He was then employed under Hawke in watching the French fleet in Brest, and under Boscawen in watching the French fleet in Rochefort. In 1762 he became a vice-admiral, and in 1775 an admiral. In 1780 he took command of the Channel fleet, but ill-health compelled him to resign the post. He was rewarded in 1782 for his great, but unostentatious services with a baronetcy. He died in retirement in 1796.

Gebir or GEBER, the earliest of modern chemists, to whom are ascribed the treatises known as *Summa Perfectionis*, *Liber Investigationis, De Inventione Veritatis*, *Liber Fornacum*, and *Testamentum*, besides a number of Arabic and Latin MSS., not as yet critically examined, in a percentage of whom little is known for certain. Some look upon him as a myth; others describe him as a Sabean of Harran in Mesopotamia, who flourished about the 10th century; others, again, make him a Greek or a Spaniard of much later date. As he is referred to by Arab writers of the 10th century, perhaps the correct view is that which identifies him with Abu Musa Dschabir Ben Haiyan, of Tarsus or Kufa, who died in 766 A.D. He held the theory prevalent among later alchemists that the metals are all identical in composition, and that by proper treatment they can be transmuted. He is also credited with a knowledge of corrosive sublimate, aqua fortis, nitrate of silver, etc. The writings ascribed to him have the merit of remarkable clearness and simplicity. By an absurd error he is sometimes spoken of as the inventor of Algebra.

Gecko, any individual of the family Geckotidae, (wall-lizards), with 50 genera and 200 species widely distributed in the warmer parts of the globe. They are of small size (the largest being little over a foot in length, and the smallest about a quarter as much), with short, thick, fleshy tongue, stout limbs, and toes armed with claws and usually furnished below with adhesive discs or suckers, which enable these animals to run up walls and along ceilings, and to scramble with great rapidity over smooth rocks. The skin is loose and tubercled, and the colours are usually sombre, though some species are clad in blue, green, and red, the males being generally more brightly-hued than the females. They feed on insects and insect-larvæ, generally digging the latter out of holes and crevices. *Platydactylus fasciolaris*, the common wall-lizard, is abundant in Southern Europe. In some species, as in *Ptychozoon homaloccephalum*, the Flying Gecko, from Java, the limbs are connected by a membrane which forms a kind of parachute enabling the animal to take long leaps. The name Gecko is derived from a clicking sound made by dragging the glottis up to the palate. All the geckos have the undeserved reputation of being more or less poisonous.

Ged, WILLIAM, the inventor of stereotyping, was a native of Edinburgh. The date of his birth is uncertain; but in 1725 he first made known his method of printing from plates, and with the assistance of a capitalist started in business in London. He failed, and died broken-hearted in 1749, having produced two Prayer-Books for the University of Cambridge, and an edition of Sallust brought out at Edinburgh.

Geddes, ALEXANDER, was born at Ruthven, Banffshire, Scotland, in 1737. He entered a Scottish Roman Catholic seminary in 1753, and thence was sent to the Scottish College in Paris, where he acquired a good knowledge of theology and of European languages. Returning to Scotland, he

held several cures, and became domestic chaplain to Lord Traquair, with whom he went to London in 1780, the University of Aberdeen having previously made him an honorary LL.D. He found a generous patron in Lord Petre, and after several preliminary publications he brought out, in 1792, the first volume of a new translation of the Vulgate. It exposed him to the attacks both of his own coreligionists and of Protestants, for it was undertaken in a liberal and scholarly spirit, with the assistance of philologists of various schools. The use of his book was vetoed, and he himself was inhibited. Nevertheless he persevered and in 1797 carried his task in a second volume to the end of the historical books, which he followed up in 1800 with *Critical Remarks on the Hebrew Scriptures*. He died in 1802.

Geelong, one of the chief towns of Victoria, Australian Commonwealth, situated on Corio Bay, 45 miles S. of Melbourne, having the Barwon river to the S. and the Bellarine Hills at the back. The town is well laid-out and very healthy. There are two parks, botanical gardens, and all the usual public institutions. The harbour is vast and deep, and the bar has been cut through at considerable expense so as to admit ships of the largest burthen. The export of wool is the chief source of prosperity; but there are extensive woollen-mills, tanneries, and paper-factories. Railways connect Geelong with every part of the colony.

Geez (pron. *Gaze*), the old Semitic language of Abyssinia, of which Tigré is the purest modern representative. It has long ceased to be spoken; but, like old Armenian and old Slavonic, it is still studied as the liturgical language of the Abyssinian Christians. Geez belongs to the Himyaritic or South Arabic division of the Semitic family, and preserves many archaic features of the organic Semitic tongue, which have been lost in the other members of the group. Thus of the fifteen primitive forms of the Semitic verb it retains no less than thirteen—that is, far more than does Arabic or any of the other cognate tongues. It is written in a peculiar syllabic alphabet running from left to right, and derived from the original writing system from which have sprung all the Semitic alphabets except the Assyrian cuneiforms. The Geez version of the Bible dates apparently from the 4th century, when Christianity was introduced into the Abyssinian highlands. Its literature also comprises numerous translations of Jewish, Greek, Christian and Arabic works. [HIMYARITIC, SEMITIC LANGUAGES.]

Gefle, a port at the head of the Gefleborglän on the coast of the Gulf of Bothnia, Sweden, halfway between Fahlun and Upsala. It stands upon two islands and upon both banks of the river that bears its name, the different quarters being connected by bridges. Its excellent harbour makes it only inferior to Stockholm and Götterburg as a business centre, and its situation and features are very picturesque. The castle, the council-house, the freemasons' lodge, and other public buildings are worthy of note. Many fires have devastated the

town, which was almost destroyed by the last in 1869.

Gegenbaur, KARL, born in 1826 at Würzburg and educated at Jena, where he became a *privat-docent* and professor of anatomy, was appointed in 1873 to the chair of that science at Heidelberg. His contributions to the learned journals appeared early, and in 1876 he began to edit the *Morphological Year Book*. About this time appeared his *Outlines of Comparative Anatomy*, which was condensed in a still more valuable work published in 1878 and translated into English by Professor Ray Lankester and Mr. Jeffrey Bell. The *Textbook of Human Anatomy* was brought out in 1883.

Gehenna, the Greek form of the Hebrew *Gehinnom*, the name of the valley of Hinnom, a deep and narrow gorge on the south side of Jerusalem. When Ahab introduced the fire-god Moloch from Phoenicia, this valley became the scene of his worship, and here many infant sacrifices took place. Josiah, on restoring the religion of Jehovah, defiled the valley by scattering dead men's bones, after which it became a receptacle for all the filth of the city. This was partly consumed in fires which were always kept burning in the valley. All these associations may have contributed to the use of "Gehenna" in the New Testament in the sense of a place of torment after death.

Geibel, FRANZ EMMANUEL, was born in 1815 in the quaint old Hanseatic town of Lübeck, where he seems in his boyhood to have acquired a poetic bent. He began the study of theology at Bonn, but gave it up for the cult of the Muse. In 1838 Bettina von Arnim got him a tutorship in Greece, where he spent two years travelling, and returned in 1840 to bring out his first volume of poetry. He next resided at Cassel, and studied Spanish romance, his *König Roderich* being the fruit of this labour. The King of Prussia granted him a small pension, and in 1852 he was appointed Professor of Aesthetics in the university of Munich. He married, and lost his wife, an episode that has left an impress on his works. His Prussian sympathies led to his quitting Bavaria in 1868, and the rest of his life was passed at Lübeck, where he died in 1884, the victories of 1870 and the unification of Germany providing him with patriotic themes. Geibel's strength lay in lyrics, and some of his songs are almost national, such as *Der Arme Tanzenichts*, *Der Zigeunerbube*, *Der Antwort*, *Der Mai ist gekommen*, *Wenn Sich Zweie Herzen Scheiden*.

Geiger, ABRAHAM, the son of a rabbi, was born at Frankfort-on-the-Main in 1810, and trained for his father's profession, following also the courses at Heidelberg and Bonn. He showed much ability, and wrote as a student valuable essays on the relations between Judaism and Mohammedanism. In 1832 he became Rabbi at Wiesbaden, and in 1838 was transferred to Breslau, where he spent twenty-five years of learned industry, producing his *Textbook on the Mischna, Studies from Maimonides*, and a treatise of high interest on the text and translation of the Bible as influencing the development of Judaism. His views brought him into conflict with

old-fashioned theologians. He was, however, made Rabbi at Frankfort in 1863, and thence chosen to the Chief Rabbinate of Berlin in 1870, dying there in 1874. Among his later works are *Pharisees and Sadducees*, *A History of Judaism*, and a Jewish prayer-book. His ephemeral publications on Semitic philology and historical and literary subjects were very numerous.

Geijer, or GEYER, ERIC GUSTAV, born in 1783 at Rarsäter, Sweden, was educated at Upsala, and went into the Record Office at Stockholm. He founded "The Gothic Society," and to its journal *Iduna* he contributed *The Viking*, the *Lost Skald*, and many other spirited patriotic poems, with many prose essays. In 1817 he was appointed professor of history at Upsala, and eight years later he completed the first volume of *Scea Rikes Häfder*, an able inquiry into legendary Swedish history. His great work, *Svenska Fullcts Historia*, appeared between 1832 and 1836, but was never carried beyond the close of Christina's reign. His *Sketch of Sweden from the Death of Charles XII. to the Reign of Gustavus III.* comes next in importance. He retired from his professorship in 1846, and died next year at Stockholm.

Geikie, SIR ARCHIBALD, F.R.S., F.R.S.E., LL.D. St. Andrews and Edin., was born at Edinburgh in 1835, and appointed in 1855 to the Geological Survey, of which he became Director in 1881. Besides his official work and his lectures as professor of geology and mineralogy in the University of Edinburgh, he is the author of many books, some technical, others popular. The chief of these are *The Story of a Boulder* (1858), *The Life of Professor Edward Forbes* (1861), *The Phenomena of the Glacial Drift in Scotland* (1863), *The Scenery of Scotland Viewed in Connection with its Physical Geology*, *A Memoir of Sir Roderick Murchison*.

Geikie, PROFESSOR JAMES, LL.D., D.C.L., brother of the foregoing, was born in 1839, and also found employment in the Survey, which he left to succeed Archibald as professor at Edinburgh. His best-known works are *The Great Ice Age*, *Prehistoric Europe*, and *Outlines of Geology*.

Geiler, or GEYLER VON KAISERSBERG, JOHANN, was born at Schaffhausen in 1445, but passed his infancy at the place in Alsace from which he got his second name. He studied at Freiburg, where he afterwards became professor, and at Basel; but his true vocation was preaching, and in 1478 he accepted a call to the cathedral of Strasburg, where he remained until his death in 1510.

Geissler's Apparatus, a small and compact form of apparatus used in chemical analysis for the speedy determination of carbonic acid in carbonates, the latter being decomposed and estimated by the loss of weight owing to the carbonic acid gas, CO_2 , evolved. Various modifications of Geissler's original form are also used for the same purpose.

Geissler Tubes. [VACUUM TUBES.]

Gelada (*Theropithecus gelada* = *Gelada ripplii*), an Abyssinian baboon, about two feet long, dark-brown in colour, and heavily maned. It is sometimes seen in confinement. [BABOON.]

Gelasius I. succeeded Felix III. as Pope in 492. He widened the breach between the Eastern and Western Churches by his quarrel with Acnicius, the Patriarch of Constantinople, and he also asserted his superiority over the Emperors and the General Councils. He died in 496, and was canonised. **GELASIUS II.** was the successor to Pascal II. in 1118, the Emperor Henry V. opposing his election. Cencio di Frangipani seized him, but a popular rising led to his release. He had, however, to leave Rome, and Maurice Bourdin was put into his place under the title of Gregory VIII. Gelasius excommunicated his rival at a council held at Capua, and secretly returned to Rome. He was soon driven into exile, and died in 1119 at the Abbey of Cluny in France.

Gelatine. That a substance, the solution of which possesses the property of setting to a jelly-like mass, could be obtained from animal products, has been known from comparatively early times. Few early details of it, however, are existent. It is at present chiefly prepared from the hides, sinews, bones, hoofs, horns, etc., of various animals by the action of hot water or steam, or a mixture of both. The various processes employed vary somewhat in their details, but the following may be regarded as typical:—The hide, etc., is cut or broken up into small pieces, which are digested for some days with a weak soda solution at a temperature of about 60° to 70° Fahr. They are then placed in an air-tight chamber until quite soft, and are afterwards washed by cold water in a revolving cylinder. After bleaching, which is effected by means of sulphur dioxide, SO_2 , they are well pressed and are thoroughly digested with hot water until as much as possible is dissolved out. The resulting liquor is strained and allowed to set upon slate or marble slabs. The crude gelatine is then cut up into strips and purified by redissolving, again straining, and allowing to cool. Pure gelatine is a hard, tough, transparent, tasteless, and inodorous substance. In dry air it remains unchanged, but if exposed to moisture it decomposes and putrefies, becoming at first slightly acid, but then alkaline, owing to the formation of ammonia. If heated, it clears and evolves fumes with a very pungent odour. Its composition varies with the source and manufacture, but generally approximates to carbon 50, oxygen 25, nitrogen 18, hydrogen 7 per cent., and frequently also contains small quantities of sulphur. No satisfactory formula representing the composition has been forthcoming. It is heavier than water, and if placed in cold water it swells considerably, absorbing from 5 to 10 times its weight of the liquid, and at about 85° Fahr. (30° C.) it dissolves in the absorbed water. If hot water be employed for its solution, a liquid is obtained, which sets on cooling if the quantity of gelatine present is not less than 1 part to 100 of water. It is insoluble in dilute acids and alkalies, but in strong acids it generally dissolves or decomposes. It is

precipitated from its solutions by tannic acid, 1 part in 5,000 of water being detectable by this means. When used as an article of food, the gelatine should be pure and carefully manufactured; its value for this purpose, however, appears to be much exaggerated in popular opinion. Isinglass (q.v.) and glue (q.v.) are respectively pure and impure forms of gelatine. It finds much employment in the arts and for manufacturing purposes. Thus, in photography it is very extensively used, as for the preparation of dry plates [GELATINO-BROMIDE], and in various printing processes. It is also employed largely in the dyeing industry, in electrotyping, waterproofing, in the manufacture of printing ink, etc., while it finds applications for many purely scientific purposes—e.g. bacteria culture [BACTERIA]—and, in the household, is used largely for making jellies and various culinary mysteries.

Gelatine Dynamite, one of the nitroglycerine explosives, resembles blasting gelatine (q.v.), and occupies a place midway between it and dynamite. It consists of thin blasting gelatine mixed with other substances, as, for example, cotton, charcoal, nitrates, etc.

Gelatino-bromide, the "dry plates" used so extensively in photography for the production of "negatives," "transparencies," "lantern-slides," etc., are prepared by coating glass with a stratum of gelatine, containing suspended through it a quantity of sensitive silver salts. The *bromide of silver*, AgBr, is that most extensively employed, and the plates are then known as gelatino-bromide. The first step for their manufacture is the preparation of the "gelatine emulsion." To effect this about 270 parts of good gelatine, which should be neither too hard nor too soft, is dissolved in hot water, and to this is added a solution of silver nitrate, 175 parts, in a little water, the liquid being well shaken, and when thoroughly mixed a solution of potassium bromide (KBr), 135 parts, and potassium iodide (KI), 5 parts, is slowly added with frequent shaking. The whole is then placed in a vessel surrounded by boiling water, and kept for about an hour. It is then allowed to cool, strained by squeezing through coarse muslin, well washed with water, and thoroughly drained. To coat the plate the gelatine is liquefied by warming, and a little is poured on the centre of the glass plate, which should be perfectly clean and level. By gently rocking the plate an even layer over the whole surface is obtained, but in the manufacture, where large numbers are made, various artifices are employed to secure an even coating. The plate is allowed to cool that the gelatine may set, and is then ready for use. Paper may be coated with a gelatino-bromide emulsion in a similar manner, and used either for the production of "positives"—e.g. the well-known "bromide-papers"—or, after rendering the paper transparent, for the production of negatives, forming different varieties of "films" (q.v.). For some purposes potassium chloride is substituted for bromide in the manufacture of the emulsion, and the resulting plates or papers are known as *gelatino-chloride*. They are not as sensitive to light as the bromide preparation, and hence require longer

exposure in the camera or when printing. It is needless to state that all the manipulations of the preparation, etc., should be performed in yellow or red light only.

Gell, SIR WILLIAM, KNT., was born at Hopton, Derbyshire, in 1777. He took his degree at Cambridge, and became a fellow of Emmanuel College. Being sent on a diplomatic mission to Greece he found ample opportunities for antiquarian researches, and on his return published his *Topography of Troy and Geography and Antiquities of Ithaca* (1807). His *Itinerary of Greece* appeared in 1810, and his *Itinerary of the Morea* six years later. *Pompeiana*, his most valuable work, was brought out between 1817 and 1831, and in 1834 was followed by *The Topography of Rome*. He died at Naples in 1836.

Gellert, CHRISTIAN FÜCHTEGOTT, born at Hainchen, Saxony, in 1715, and educated at the university of Leipsic, obtained a professorship of philosophy there and held it till his death in 1769. Gellert was the author of a volume of *Fables and Tales*, and of a collection of moral and sacred poetry, both conceived in a spirit of simple and natural piety. His comedies, pastorals, and one romance are not of any considerable merit.

Gellius, AULUS, is known to us only by his curious commonplace-book entitled *Notes Attice*. He must have flourished in the 2nd century A.D., probably from 120 to 180, and appears to have studied in Athens and held subsequently some judicial office in Rome. His work, begun to while away the winter nights in Greece, was continued through many years, and consists of an undigested mass of notes on every conceivable topic, interlarded with extracts from authors, many of whom would be otherwise unknown.

Gelon I., son of Dinomenes, after serving as a soldier under Hippocrates, tyrant of Gela, in Sicily, succeeded that monarch in 491 B.C. He then made himself master also of Syracuse by adopting the cause of the plebs, and he used his power so as to add immensely to the importance of the State. In 480 he defeated Hamilcar at Himera, on the same day, it is said, that the battle of Salamis was won by the Greeks. Before his death in 478 Sicily was virtually subject to him, and his memory was so respected that, when all memorials of tyranny were being swept away, his statues remained intact. **GELON II.**, son and colleague of Hiero II., of Syracuse, was born about 266 B.C. He was a patron of Archimedes and an ally of Rome, but after the disaster at Cannæ he is reported to have contemplated abandoning the alliance when he died in 216. He left a son, Hieronymus, and his father survived him.

Gemmation, the method of reproduction by the formation of buds, which may be separated as independent individuals as in the *Hydra*, or remain connected with the parent as in the compound corals.

Gemmi Pass, a picturesque and much-frequented Alpine road, 24 miles S. of Thun, connecting the cantons of Valais and Berne. From

the baths of Leuk the road is hewn out of the solid rock, and attains a height of 7,160 feet above sea-level.

Gemmules, a special method of gemmation which occurs in some sponges such as *Spongilla* (the common fresh-water sponge) and *Tethya*. They are groups of cells, sometimes protected by a layer of spicules, which are separated from the parent.

Gems, stones of exceptional beauty and value. In archaeology the term is applied to engraved precious stones, used for sealing or as a personal ornament, or applied to decorative purposes. Signet rings became general among the Greeks and Romans, but apparently sealing was not the purpose for which gems were originally worn. The art of gem-engraving was carried by the ancients to a degree of perfection which no subsequent efforts have reached. It is doubtful whether it originated in Egypt or Assyria. From the harder quality of the stones used in Egyptian art, it may be inferred that it would more naturally spring up there, but the early use of soft stones and simple instruments points rather to Assyria. The gems of the two peoples have not much in common. The earliest found in Assyria are cylindrical in form, bored through their length to admit a cord, by which they were fastened to the wrist. Babylonian gems resemble the Assyrian, but in Persia, where chalcedony was the favourite material, a conical shape was afterwards substituted, and the design was engraved on the base. The Egyptian gems are mostly scarabs, and the same form predominated among the Etruscans, where the art was in a very flourishing condition in the 3rd century B.C. The first Greek artist whose name is recorded is Theodorus of Samos, who engraved the emerald in the ring of Polycrates; but it is doubtful whether any genuine intaglios now existing can be referred to an earlier period than the Peloponnesian War. Greece afterwards produced many famous engravers, including Pyrgoteles, who was employed by Alexander the Great. Sards, jacinths, and amethysts were the stones most used. The engravings represent mythological and heroical subjects, as well as portraits of deities, kings, and historical characters. The art of engraving in cameo—a species of relief executed in stones consisting of differently coloured layers—seems to have been introduced under Alexander's successors. As the fragments of Alexander's empire were successively conquered by the Romans, they became acquainted with gem-engraving, which was henceforward practised at Rome, reaching its highest development there during the period of the early emperors. Among artists of this age Dioscorides, who lived in the time of Augustus, holds the first place. Pliny gives an exhaustive list of stones used by the Romans. Very hard and valuable stones, such as the diamond, sapphire, and ruby, seem to have been seldom engraved. The sardonyx was especially adapted to cameos, on account of its fourfold variety of colour—blue, black, white, and red. The other stones used included the emerald, sard, beryl, amethyst, onyx, jacinth, topaz, opal, and garnet. The engravings

on Roman gems resemble the Greek in their general character. After the 2nd century A.D. the art gradually declined, and appears to have been almost, if not completely, lost during the Middle Ages. At the close of the 15th century it was revived by Lorenzo de' Medici, and flourished in Italy for about a hundred years. In the 17th century it was cultivated with much success in Germany and France, and since then there have been many skilful engravers in all the chief countries of Europe. The attempt to manufacture artificial gems, which dates from the discovery of the chemical composition of precious stones, has met with considerable success during recent years.

Gemsbok (*Oryx gazella*), a large South African antelope, with long, straight, obscurely-ringed horns, abundant in the Kalahari desert. The hair is fawn or yellowish above and white below, the coloration being separated by an irregular black band, and there are markings of the same colour on the face and limbs. It is fierce in disposition, and is said to be able to beat off the lion with its long horns. [ORYX.]

Gendarmes (French, "men-at-arms"), originally a body of French cavalry, first enrolled in the reign of Charles VII. The name has been transferred to the French police force, which dates from the year 1790. The gendarmerie forms a part of the regular army, and includes both mounted and unmounted soldiers, usually selected from other corps on account of their superior character and ability.

Gender, a distinction between words based on the difference between the sexes. Grammarians recognise three genders—masculine, feminine, and neuter—though the neuter is not really a gender, since it merely denotes that a word is *neither* masculine nor feminine. The fact that in ancient languages many lifeless objects are masculine or feminine instead of neuter may perhaps be attributed to the primitive view of the universe, which endowed all things with personality and consciousness. Then, later, words acquired a gender on account of the similarity of their endings to words already in existence. There is no neuter in Semitic languages, and it has disappeared in the Romance languages—words originally neuter having become masculine or feminine—but it remains in German and various other Aryan tongues. In English gender survives only in the personal pronouns (*he*, *she*, *it*, etc.), and a few other ancient forms.

General, in the Roman Catholic Church, the head of the various communities forming a religious order. The general of an order is answerable to the Pope alone, being free from episcopal control. Next in rank to the general are the provincials (q.v.), and below these are the heads of separate institutions as abbots, priors, etc. The general is usually elected for a term of three years, but in the case of the Jesuits for life. The elective body is the general chapter, commonly composed of the provincials and some of the chief heads of houses. An election is not valid till it receives the Pope's assent. The general lives at Rome, where he takes

part in general councils. He sends out visitors to inquire into local abuses and disputes, and holds a general chapter at certain fixed intervals.

General Average is the share paid by each party interested in any maritime venture for any expenses that have been voluntarily incurred for the advantage of the parties involved. Part of the cargo or part of the ship itself may be sacrificed for the sake of the remainder, and if this loss be not due to imperfect stowage or to fault of the master it is recovered by the general average. The settlement of this average is often a question of much complexity, and is arranged by special accountants known as *average adjusters*. Difficulties occur in the lack of agreement between the codes of rules adopted in the different countries, but the York-Antwerp code formed in 1877 is being gradually adopted, by reason of its special mention in bills of lading and insurance policies. [PARTICULAR AVERAGE.]

Genesee, a river which rises in Pennsylvania in the same spot as the Susquehanna and Alleghany, and flowing through New York State, where it gives its name to a county and township, discharges itself after a course of 153 miles into Lake Ontario. At Rochester it falls 226 feet in a few miles, but is navigable for small craft above and below that point. A county in Michigan also bears this name.

Genesis (abbreviated form of *genēsis kosmou*, "origin of the world"), the word used in the Septuagint to translate the Hebrew *Bereshith*, the name of the first book of the Pentateuch. Genesis, like the rest of the Pentateuch, is written on a clearly-conceived plan --viz, to show how God chose out a people sacred to Himself, and to narrate the circumstances which preceded and attended that manifestation of the Divine Will. First among these, in order of time, was the creation of the human race itself and the place of its habitation. As the history advances, its scope gradually becomes narrower, everything being left on one side which has no direct bearing on the writer's main purpose. The narrative moves forward rapidly till we reach the call of Abraham, which may be regarded as the central point of the book, as the giving of the law on Sinai is of the whole Pentateuch. From this point onwards we have a detailed account of the lives of the Hebrew patriarchs, in regular order from father to son, and the style at the same time becomes more lively and flowing. The theory, however, that the book resulted from a compilation of older documents, first propounded by the Belgian physician, Astruc (1753), is now accepted by many competent Biblical scholars. The number of documents is disputed, but one can trace at least two, distinguished by the names they respectively assign to the Almighty—*Elohim* and *Jehova*. It is generally held that the "Jehovist" incorporated in his own work that of an earlier "Elohist." The "Jehovist" was probably Moses, but others refer the composition of the book to a much later period.

Genette, *GENET*, a genus of Viverridae, with five species from Africa and Western Asia, one

(*G. vulgaris*) ranging into Southern Europe, where it is sometimes domesticated as a mouser. The genettes are smaller than civets (q.v.), and have retractile claws, and the anal pouches very small and without perceptible secretion. The fur is grey with dark round or oblong patches.

Geneva (Fr. *Genève*; Ger. *Genf*; Ital. *Genova*) a walled town, capital of the canton of the same name in Switzerland, is situated at the point where the Rhône issues from the S.W. extremity of the Lake of Geneva. An *oppidum* and a bridge existed here in Caesar's time, and the inhabitants were Celtic Allobroges, but across the river dwelt Helvetii. It is conjectured that the site was in prehistoric times occupied by a group of lacustrine dwellings, but the depth of alluvium conceals all traces of such structures. Till the end of the 4th century of our era Geneva was more or less subject to Rome. It then passed to the Burgundians, and became in 534 part of the kingdom of the Franks. For two centuries or more the chief authority rested with the bishops under the protection of the Emperors, of the Kings of Burgundy, or the Counts of the Genevois. Calvin saved his countrymen from Catholic domination at the cost, no doubt, of some sacrifice of freedom in opinion, but after his death democracy again asserted itself, and was then opposed by internal oligarchy. Even the temporary annexation by the French Republic in 1798 failed to establish a solid democratic constitution. The older and wealthier families still monopolised the conduct of affairs. Geneva is divided into two by the Rhône, which is traversed by five bridges, and has a small port upon the lake. Commanding a view of Mont Blanc to the S. and of the Jura to the N.W., it is well placed, though the actual site is somewhat flat and uninteresting. The old town clusters round the cathedral, a half-Gothic, half-Romanesque structure of the 12th and 13th centuries with incongruous additions. It is small, contains some fifteenth-century glass, a few sepulchral monuments, and the remains of the old stalls. The town-hall dates from the 15th century, but the existing fabric is more modern, and possesses little interest save as having been the scene of the *Alabama* Conference in 1872. The court-house is a good specimen of the Mansard style, and the arsenal deserves notice. Among modern buildings the most important are the Athénée, the Rath Museum, the Fol Museum, the Conservatorium, the electoral Palace, the University, the Hall of the Reformation, and the Russian church. Railway communications make the place easy of access from all parts of Switzerland, from France, Italy, and Germany. Steamboats ply constantly to the various ports on the lake. The chief trades are watchmaking, the manufacture of musical-boxes and scientific instruments, silks, calicoes, and chemicals, printing, and wood-carving. To political and religious refugees of all sorts Geneva has been a sanctuary for many years.

Geneva, THE LAKE OF, or LAKE LEMAN (classic *Lacus Lemanus*), lies between Switzerland and the department of Haute Savoie, France, extending in a crescent shape from E. to W. for a total length of 53 miles, with a mean breadth of

6 miles, a superficial area of 223 square miles, and a level of 1,230 feet above the sea. The W. extremity narrows suddenly to some two miles from the strait of Promonthoux, and this part, about 14 miles long, is sometimes called "The Little Lake." The greatest depth (1,095 feet) is attained between Evian and Ouchy. The water is remarkable for its blue colour, and is liable to rather peculiar movements, called *seiches*, which cause a rise of as much as four feet first on one shore, then on the other. There are also local winds—e.g. the Bise from N.E., the Bornaud from the Savoy valleys, and the dry Séchard from S. Besides the Rhône, which enters near Villeneuve at the E. end and issues at Geneva, the lake receives several small rivers as the Dranse and the Venoge. Fish are not very abundant, but the fresh-water fauna at the lowest depths possesses considerable interest. It is never wholly frozen over. The shores are undulating, well-wooded, and fertile on the N., but more boldly picturesque and less cultivated on the S. Nyon, Rolle, Morges, Ouchy, Lausanne, Vevey, Montreux, and Clarens (the scene of Rousseau's romance) are the chief spots on the Swiss littoral. Evian, Thonon, and Ferney (Voltaire's residence) are the only places of interest on the French side.

Geneva, THE CANTON OF, the smallest of Swiss cantons, has an area of 108 square miles, being bounded S.W. by the French departments of Haute Savoie and Ain, N. by the canton of Vaud, and E. by the Lake of Geneva. The surface is undulating but not mountainous, and the soil is highly cultivated, yielding cereals, fruit, and wine. Building stone and bituminous shale are the only mineral products. The city of Geneva makes the density of the population considerable. French is the prevailing language, but a German element is gradually growing stronger.

Geneviève, or GENOVEFA, the patron saint of Paris, was born about 425 A.D., probably at Nanterre. She is reported to have entered upon the religious life at the age of seven under the influence of St. Germain d'Auxerre. She acquired high repute for piety and austerity, and also for prophetic power, which enabled her to predict Attila's invasion and retreat. In 460 she built the first church over the remains of St. Denis, and at her death towards the beginning of the next century the fane of Ste. Geneviève, afterwards merged in the Panthéon, was raised over her grave. Her day is kept on January 3. In the 17th century religious orders for both sexes were established in her name. The *filles de Ste. Geneviève* have more recently been known as *Miramiones*, and devote themselves to nursing and teaching.

Genghis Khan, also written JENGHIS or ZINGIS KHAN, a Mongolian prince, was born about 1160, and succeeded to the throne at the age of thirteen. His early years were spent in petty wars against local tribes, but in 1206 he invaded China, and breached the Great Wall. He renewed his attack twelve years later, stormed Pekin, and ultimately established his supremacy over the northern provinces, adding Eastern Persia, Samarcand,

Bokhara, and all Tartary to his dominions. It is computed that his conquests cost the lives of five millions of men. One of his most famous battles was fought in 1225 on the frozen lake of Koko Nor after a winter march across the Desert of Gobi. He then penetrated farther into China, and stormed Nankin. His empire extended from the banks of the Dnieper to the China Sea. He died on the march in 1227 near the banks of the river Sale, and his vast dominions were divided between his four sons. Though as cruel and unscrupulous as most conquerors, Genghis possessed some good qualities. He drew up a code, which still prevails; he showed religious toleration; and to his soldiers and his trusted friends he was just and generous.

Genista, a genus of leguminous plants, comprising about 100 species of small branching shrubs from one foot to six feet in height and often spinous, which are natives of Western Asia, Europe, and North Africa. They bear simple or trifoliate leaves with minute stipules or exstipulate, and their flowers are yellow and in racemes. The bilabiate calyx is five-toothed: the keel petals of the papilionaceous corolla are deflexed after flowering; and the ten stamens are all united below, and are alternately short with versatile, and long with basifixed anthers. There are three British species: the spinous Petty Whin or Needle Greenweed, *G. anglica*; the rare *G. pilosa*; and the Woadwaxen or Dyer's Greenweed, *G. tinctoria*, the *plante génit* from which the royal family of Plantagenet derived their name and badge. The latter plant was formerly used to give a yellow dye, which, on the addition of the blue woad (q.v.), yielded Kendal green.

Genius, the name given by the Italian races to the protecting spirit or tutelar deity of a person, place, or thing. Every individual was supposed to have a genius (*genius natalis*), a spiritual second self, who influenced his conduct and fate. Later, an evil genius was also imagined, and a man's good and bad actions were attributed to his good and evil genius respectively. From this pagan notion was developed the idea that every person has a guardian angel. [DEMONOLOGY, FAMILIAR, JINN, NEO-PLATONISM.]

Genlis, STEPHANIE FÉLICITÉ, COMTESSE DE, was born at Champéry, near Autun, Burgundy, in 1746. She received a good education, and in 1761 married Comte Brusart de Genlis, afterwards Marquis de Sillery, who perished a victim of the Revolution in 1793. Her aunt, Madame de Montesson, having secretly married the Duc d'Orléans, had her appointed governess to her husband's children, one of whom was the future Louis Philippe. She began early to write on educational and moral subjects, and no fewer than ninety works came from her pen. Chief among these are *Le Théâtre de l'Education*, *Annales de Vertu*, *Lettres sur l'Education*, *Les Veillées du Château*, *Les Petits Émigrés*, and a number of historical romances. In 1792 she went into exile, but returned to receive a pension from Napoleon, which was continued by the Orleanist princes after the Restoration. She died in 1830, leaving several volumes of *Mémoires*.

Genoa (classic *Genua*; Ital. *Genova*; Fr. *Gênes*), a walled city and seaport at the head of the Gulf of Genoa in the Mediterranean, 79 miles S.E. of Turin, and capital of the province which bears its name. A place of importance as early as the second Punic War, it became, at the close of the dark ages and the struggle against the Moslems, the head of a powerful commercial republic, which rivalled Venice and maintained its independence from the 11th to the 18th century. In 1797 it was incorporated by France with the Ligurian Republic, and in 1815 ceded by the Peace of Paris to Sardinia, an act which was for many years deeply resented by the inhabitants, who were stimulated by Mazzini to an ineffectual revolt in 1830. The narrowness of the foreshore has compelled the city in its growth to climb the steep flanks of the Ligurian Alps, and the aspect of its marble palaces, churches, and thickly-crowded houses, piled one above the other over the crescent-shaped harbour, quite justifies its assumption of the epithet "Superb." The walls have from time to time enlarged their circuit, and have now a sweep of some dozen miles. Scattered among the streets are the grand palaces of the old merchant-princes, the Doria-Pamphilj, the Brignolo, the Durazzo, the Balbi, the Pallavicini, and many others, some of which are now public offices, others being museums of art. The cathedral, dedicated to St. Lawrence, dates back to the 9th century; but the existing structure with its Saraceno-Gothic features is two centuries later, and much of the external architecture and internal decoration belongs to a more recent period. Other churches of interest are St. Ambrose and St. Philip, the Annunziata, Santa Maria delle Vigne with its campanile, San Siro, and Santa Maria di Carignano, many of which possess fine pictures. The harbour, protected by two moleys, is semicircular, having a radius of $\frac{3}{4}$ mile. Lines of steamers afford communication with every quarter of the world, and the railway system now brings the town into connection with the whole of France and Italy. Genoa possesses an archbishopric, a university, a complete educational organisation, a naval school, an academy, libraries, and very wealthy charitable institutions.

Genre (Latin *genus*, "kind"), a "kind" of painting, in which domestic interiors, rustic festivals, and similar scenes are represented. Human figures are an essential characteristic of *genre*, and these must be types of a class, not real characters as in historical pictures. The present style of *genre*-painting arose in the Netherlands in the 16th century. In France the term has a wider significance, being used to classify the various kinds of painting, as *genre du paysage* (landscape), *genre historique*, etc.

Genseric, King of the Vandals, was born at Seville about 406 A.D. He was chosen to succeed his elder brother in 427. On the invitation of the rebel general Boniface, he attacked the African colonies of Rome in 429, and compelled the emperor to surrender to him Western Numidia and Mauretania. Eudocia in 455 begged him to take vengeance on Maximus for the murder of Valentinian, and he stormed and sacked Rome, carrying off the empress.

and her daughter as prisoners. Neither Majorian nor Leo was successful in their attempts to punish the barbarian, who pushed his conquests from Sicily to Corsica and from Thrace to Asia Minor and Egypt. He died in 477, and his dominions were to some extent dismembered by Belisarius.

Gentian, the name of a genus of gamopetalous, herbaceous plants, comprising about 150 species and forming the type of the order *Gentianaceæ*. They are perennial plants with opposite, decussate, simple, sessile, and entire leaves and cymosely-grouped, polysymmetric, tetramerous, or pentamerous flowers. The calyx is valvate, and the corolla contorted in the bud: the stamens form one whorl, and are epipetalous and included; and the two carpels unite in a one-chambered, many-seeded ovary with two stigmas, which gives rise to a capsular fruit. The corolla is commonly a deep blue, such species occurring at an altitude of 16,000 feet in the Himalayas: red flowers are almost confined to the Andean forms; and white and yellow also occur. They belong mostly to hilly or mountainous situations in the temperate regions of the northern hemisphere. Five species are natives of the British Isles. [GENTISIN.]

Gentianin. [GENTISIN.]

Gentiles, in the Old Testament, translates a Hebrew word, meaning "foreigners" as opposed to Israelites. In the New Testament it is used to translate two Greek words, *ethne*, "nations," corresponding to the Hebrew word mentioned above, and *Hellenes*, literally "Greeks" (as in Romans ii. 9, 10, etc.). Most of the foreigners with whom the apostles came in contact spoke Greek.

Gentio-picrin. [GENTISIN.]

Gentisin, a yellow crystalline substance of composition represented by $C_{10}H_{10}O_5$, which occurs in gentian root. From this source it may be obtained by (1) maceration with cold water, and then (2) extracting with hot alcohol. It forms large yellow needles, melting at 203°, insoluble in water but soluble in alcohol and alkalies. It was formerly much confused with another constituent of the root—*gentio-picrin*, $C_{20}H_{30}O_2$, to which the root owes its medicinal properties—both being called *gentianin*.

Gentleman seems to have been always used in a vaguer and more general sense than Esquire to denote one whose birth, wealth, or good breeding gave him a superior social position. There remain "titles of gentility" granted by Richard II. and Henry VI., but these apparently conferred the rank of Esquire. The name could be applied to anyone above the rank of yeoman, and there is no ground for supposing that it ever had any more definite and restricted meaning. As now employed, it usually implies both that the individual described is more or less refined, and that his parents occupied a certain position in society, but it is sometimes used to convey only one of these two notions.

Gentlemen-at-Arms, a royal body-guard established by Henry VIII. in 1509, and originally

entitled "gentlemen pensioners." The corps consists of a captain, a lieutenant, a standard-bearer, a clerk of the cheque, and forty gentlemen, all in receipt of a salary. Commissions are given by the Crown, on the recommendation of the commander-in-chief, as a reward for distinguished military service. Gentlemen-at-arms still attend the sovereign on certain solemn and festive occasions.

Gentoo (Portuguese *gentio*, a "Gentile" or heathen), a term formerly applied in a vague way to the pagan inhabitants of the Indian seaboard, and then more particularly to the Telugu people of Madras. The expression "Gentoo language" was always understood to refer to the Telugu, which is a chief member of the Dravidian linguistic family. [DRAVIDIAN.] In Jagor and Kærbin's lists there is a low-caste Madras tribe still specially known by this name.

Gentz, FRIEDRICH VON, the son of a Prussian official, was born at Breslau in 1764. He held for a time a post under the Prussian Government with the rank of Kriegsrath. His sympathies with the French Revolution were counteracted by Burke's *Reflections*, which he translated into German. Visiting England at the end of the century, he made the friendship of Mackintosh. He now became a professional political writer, having apparently no convictions, but being ready to serve any party with his pen. He steadily opposed, however, the spread of the Revolution and the rise of Napoleon. In 1802 he transferred himself to Vienna, accompanied Castlereagh to the Conference there, and was present at all the subsequent congresses. He died in 1832.

Genuflexion, the act of bending the knees in worship, as a token of submission or penitence.

Genus, in *Biology*, denotes a group of species of animals or plants, possessing common essential details of structure. A genus may consist of a single species or of very many; in the latter case it is usually divided into sub-genera. The scientific name of every organism in the binomial nomenclature of Linnaeus consists of two parts: the first generic, the second specific—e.g. *Felis leo*, the lion; *Felis tigris*, the tiger.

Geocentric, in *Astronomy*, refers to those motions which have the earth for centre, or which are measured in relation to the earth. Thus, the motion of the moon in a slightly elliptical orbit round the earth at one focus is called geocentric. The geocentric latitude of a planet is the angle made by the line joining it to the earth with the plane of the ecliptic. The geocentric longitude is the angular distance of the planet measured along the line of the ecliptic from a certain standard point, known as the first point in Aries.

Geode, or POTATO-STONE, a bubble of quartz forming a hollow, rounded body, often several inches in diameter, and generally lined with crystals. Externally geodes often resemble potatoes. They have originated in igneous rocks, and seem to represent the initial stage in the formation of agates (q.v.).

Geodesy is the science of measuring lines and areas on the surface of the earth. It is effected by means of triangulation (q.v.), and requires for great lengths or areas a knowledge of certain rules in spherical trigonometry. It is required in the determination of the dimensions of the earth and in the preparation of maps.

Geoffrey of Monmouth, an ecclesiastic who flourished in the first half of the 12th century, dying as Bishop of St. Asaph in 1154. He is the author of the *Chronicon sive Historia Britonum*, the two other works attributed to him being spurious. He professes to have translated this curious record from the Breton, but there can be no doubt that this statement is false. The book is compiled from Gildas, Nennius, Virgil, and other early authors, with a number of current legends thrown in, the whole being dressed up by a vivid and unscrupulous imagination.

Geoffrey IV., Duke of Anjou, known as Plantagenet from his adoption of the *genista* or broom as his badge, was born in 1113. He married Maud, daughter of Henry I. of England and widow of the Emperor Henry V. He maintained a long and fruitless struggle with Stephen for the possession of Normandy, but his son Henry founded the Plantagenet dynasty in England. Geoffrey died in 1150 on his return from the crusade in which he had joined Louis VII.

Geoffrey II., Duke of Brittany, third son of Henry II. of England and Eleanor of Aquitaine. He married Constance, daughter of Conan, Duke of Brittany, and with Henry II.'s aid usurped his father-in-law's throne. He was killed at the age of 28 in a tournament at Paris (1186), and left the ill-starred Prince Arthur, who was put to death by King John.

Geoffrin, MADAME THÉRÈSE RODET, the daughter of a *valet-de-chambre* at the French Court, was born in 1699. She married a rich glass-maker, who left her a widow. Her wealth was mainly devoted to encouraging literature, and her salon was frequented by Diderot, Marмонтel, D'Alembert, Walpole, Gibbon, and Hume. The *Encyclopédie* was largely subsidised by her. She was invited by Stanislaus to Warsaw, and was received by Maria Theresa at Vienna. She died in 1777.

Geoffroy St. Hilaire, ÉTIENNE, was born at Étampes in 1772, being the son of a not over-prosperous lawyer, who intended him for the priesthood. However, in Paris he became associated with Brisson and Haüy, the naturalists, and the outbreak of the Revolution further induced him to change his destination. Ultimately he entered the Museum of Natural History, where he allied himself with Cuvier, and both together helped to build up that famous zoological collection and to plan the Jardin des Plantes. He accompanied Napoleon to Egypt in 1798, and Junot to Portugal in 1808. In 1818 appeared the first part of his *Philosophie Anatomique*, in which he set forth his long-cherished views as to the unity of organic structure. When he went on to extend his theory to the invertebrate animals, Cuvier rose in arms, and a long warfare

ensued, ending, however, in peace and renewed friendship. Losing his sight in 1840, Geo. Troy St. Hilaire died in 1844.

Geography, ASTRONOMICAL or MATHEMATICAL, is that department of the science which treats of the relations of the earth to the other heavenly bodies; of its form, size, and movements; of the mathematical divisions of its surface and the determination of the true position of places on that surface; and of the delineation of its surface on maps. Several of these topics have been already dealt with in the article EARTH (q.v.). The earth is the third, or possibly the fourth planet (q.v.) in order of distance from the sun, round which it travels in an elliptic orbit at a mean distance of 92,800,000 miles, accompanied by one satellite, the moon (q.v.). This movement round the sun is termed *revolution*; and the time occupied by the earth in performing it, a *year* (q.v.). The rate at which it moves, though averaging rather more than 65,000 miles an hour, varies with its distance from the sun, which occupies one focus of its orbit. In consequence of this revolution the sun appears to describe a circle in the heavens in the course of a year, moving constantly towards stars farther east, whilst the stars last seen near the point where it appears to rise, and those first seen near where it sets, differ at different seasons. The earth has also another movement, that of *rotation*, turning on its own axis, the line forming its shortest diameter, once in a *day* (q.v.) from west to east. This causes the apparent movement of the sun and other stars from east to west, and also the alternation of light and darkness, day and night, there being always half of the globe turned towards the sun and half away from it. Since an entire rotation takes twenty-four hours, the *circle of illumination*, or line of junction between the dark half and the illuminated half of the surface, traverses $\frac{1}{24}$ th of the circumference in four minutes, and this distance is termed a *degree of longitude* (q.v.). The line due north and south through any place—*i.e.* the line occupied by the circle of illumination at any one moment—is the *meridian* (q.v.) of that place, and the meridian that marks the advancing edge of the circle of illumination unites places having simultaneous sunrise, whilst that marking its retreating edge unites those experiencing sunset. There is no natural starting-point from which to measure longitude, no natural *standard meridian*; but that of Greenwich Observatory is now generally adopted as 0° , degrees being numbered east and west from it to that of 180° , the other half of the same great circle or circle which, like all meridians, by passing through the two poles divides the earth's surface into two equal hemispheres.

On the other hand, in the extremities of the axis, or *poles*, we have two naturally fixed points from which *latitude* (q.v.), or distance north and south, can be calculated, but we measure it from a circle midway between the poles known as the *equator*, which is reckoned as 0° , the poles being 90° N. and 90° S. lat. respectively, and 89 parallel small circles, or *parallels of latitude*, a degree apart and diminishing in diameter towards each pole, being described

between the equator and each pole. By reference to these two sets of lines the position of any spot on the earth's surface can be defined.

Degrees of longitude diminish from rather more than 69 miles at the equator to nothing at the poles, whilst a degree of latitude is everywhere about 69 miles, and would be of uniform value but for the flattening of the earth at the poles. That it is so flattened, or is an *oblate spheroid* (q.v.), and the amount of flattening, about $13\frac{1}{2}$ miles at each pole, is demonstrated by experiments on the increase of the attraction of gravity as we travel polewards, as indicated either by a spring-balance or by the increased number of oscillations of a standard pendulum (q.v.); and by the careful measurement of arcs of the meridian in various latitudes.

The fact that the earth's axis of rotation is not perpendicular to the plane of its orbit, or, as it is termed, the *ecliptic* (q.v.), but is inclined to it at an angle of $66^\circ 32'$, causes that inequality in the length of day and night and in the noon altitude of the sun that we know as the *seasons* (q.v.). Thus about March 22nd the sun appears vertical over the equator, and we have equal day and night of twelve hours each over the whole world (except at the poles), whence this season is called the *vernal or spring equinox*. After this the days exceed the nights in length in the northern hemisphere until about June 22nd, the sun constantly attaining a higher noon altitude and so appearing to travel northward until that date, when it appears vertical over all places $23\frac{1}{2}^\circ$ N. of the equator, whilst the north pole, and by that date all the area $23\frac{1}{2}^\circ$ S. of it, passes the whole twenty-four hours within the circle of illumination. The days in the northern hemisphere then shorten until September 22nd, the *autumnal equinox*, so that the sun appears to have reached by June a culminating point or turning-line, whence this June season is termed the *summer solstice*, and the line $23\frac{1}{2}^\circ$ N. of the equator a *tropic*. Similarly, on September 22nd, the sun is again vertical over the equator, and by December 22nd, the *winter solstice*, over the southern tropic. The variation in the length of the day, and in the directness or obliquity with which the sun's rays strike any part of our earth, thus produced, are two of the most important factors in climate, but are the same for all places on the same parallel of latitude. The greater length of the summer day as we approach the pole to some extent compensates for the low altitude of the sun, allowing corn, for instance, to be grown even within the Arctic Circle.

By means of the natural lines of the tropics and circles, $23\frac{1}{2}^\circ$ and $66\frac{1}{2}^\circ$ respectively from the equator, the earth's surface is divided into five zones of illumination—the torrid, two temperate (northern and southern), and two frigid zones; but the distribution of land and water and other minor causes prevent these being true zones of climate (q.v.).

One other relation of the earth to other heavenly bodies is of geographical importance—viz. the differential attraction of the moon, and to a low degree, owing to its enormously greater distance, of the sun, upon the land and the water of our globe, which produces the *tides* (q.v.).

The *projection* of the whole or a part of the

earth's curved surface on to a flat one, such as a sheet of paper, forms a *map* (q.v.), and the various modes in which the circles of latitude and longitude may be represented practically constitute the differences between the various methods of projection.

Geography. PHYSICAL, though sometimes taken as including those topics here alluded to as Astronomical or Mathematical Geography (q.v.), may be succinctly defined as that department of the general science of geography that deals with the scientific description and explanation of the present natural aspect of our earth and its inhabitants, and the changes that are now taking place on its surface. Since all the phenomena that we see around us to-day are but the results of countless series of changes that have been in progress during incalculable ages, physical geography is in some respects the last chapter of geology (q.v.); but, from the light which the investigation of causes now in operation throws upon the agencies at work in past times, its study forms practically a most important introduction to that of the dynamical department of geology. Physical Geography includes the study of the atmosphere (q.v.); its temperature, moisture, pressure, and consequent movements or winds (q.v.), most of which conditions make up that which we term climate and form the subject of the special science of meteorology (q.v.). It also deals with the inner, aqueous envelope, which covers about eleven-fifteenths of the surface of the globe, the ocean (q.v.) or *hydrosphere*, with its waves, tides (q.v.), and currents (q.v.). In relation to the solid earth, or *lithosphere*, the science deals with its distribution in continents and islands; its horizontal contours, or coast-lines, and its vertical contours, or relief, in plains, plateaux, hills, mountains, and valleys; the agencies that have effected this earth-sculpture, such as frost (q.v.), rain (q.v.), underground waters, rivers (q.v.), glaciers (q.v.), and ocean-waves, the *epigene* or surface agencies, as they are termed; and those more obscure, because *hypogene* or subterranean, agencies, including the earthquake (q.v.) and the volcano (q.v.) and also probably other less violent agents which result in the tilting, folding, and crumbling of originally horizontally stratified rocks in the processes of *mountain-building*. Finally, Physical Geography is concerned with *chorography* or the distribution (q.v.) of vegetables and animals as affected by such natural causes as soil, temperature, light, moisture, altitude, proximity to the sea, and climate generally, together with their involuntary or instinctive migrations. One of the most interesting generalisations in this department of the science is that the successive altitudinal zones of vegetation on a snow-clad mountain near the equator from the sea-level to its summit present much similarity to the latitudinal zones met with at or near sea-level in going from the equator to the poles. The distribution of the various races of man, the subject of *ethnography*, and the physical causes which limit the dispersal and affect the concentration of the human species under the operation of its own free-will, form the transition from Physical to Political Geography. Whilst the intense cold and long

winters of the north allow only of the scanty vegetation that furnishes pasture for the reindeer of a small nomadic population, the enervating heat of the luxuriant tropical regions proves equally fatal to human energy. The oldest civilisations of which we have any record arose in the warmer temperate zone, and were in some cases, as in those of Assyria, Babylon, and Egypt, promoted by the fertilising effects of periodical inundations of rivers, whose waters were available for irrigation. Later empires, such as much of that of Rome, Britain, Germany, and the United States, have originated in colder regions, where forests have had to be cleared and fens to be drained. Natural facilities, such as good harbourage, a tidal or other navigable river, the confluence of two rivers, the possibility of bridging a river, the convergence of mountain-passes, an oasis in a desert, a good supply of spring-water, or the proximity of mineral wealth, such as coal and iron, have determined originally the position of most large towns. Even their expansion in modern times may be similarly influenced, as in the cases of the suburban villages on the patches of water-bearing gravel round London, which are only now being connected by buildings over the intervening waterless clay districts, and of the often-flooded meadows of the Lea that so obstruct the spread of the metropolis eastward.

Geographical Distribution. [DISTRIBUTION.]

Geology may be defined as the science of the composition, structure, and physical history of the earth. The study of this comprehensive subject by scientific methods is of very recent date, belonging almost entirely to the 18th century; and, though an immense accumulation of facts and their logical inferences has already been collected, very much yet remains to be learnt. In former times many speculative guesses were made at the causes of some of the appearances presented by the rocks forming the earth's surface, the fossils they contain, the mountain-chains into which they are elevated, or the earthquakes and volcanoes by which they are disturbed. These guesses were, however, but little supported by any systematic appeal to facts, whilst modern geology is recognised as pre-eminently a science of observation, finding the chief explanation of the structure and history of the rocks in the facts of Physical Geography (q.v.), and holding it illogical to imagine unknown agencies to have operated in the past until we have exhausted the possibilities of those now in action. Subject to certain qualifications as to the very beginnings of its record, it has, therefore, for its chief principle that known, from its populariser, Sir Charles Lyell, as the Lyellian maxim, that the causes in operation in the past were the same in kind and even largely in degree as those now in action.

To aid him in his investigations the geologist borrows so largely from chemistry, mineralogy (q.v.), botany, zoology, physics, and even from mathematics and astronomy that the very existence of geology as an independent science has been denied. It would, however, be as reasonable to refuse the name of science to the study of history

because of its indebtedness to literature and other subjects. The methods of the geologist and the various branches of his inquiries have, indeed, often been compared to those of the historian deciphering the ill-kept and fragmentary chronicles of some forgotten races from records well-nigh obliterated and written in an unknown language. The crystal as it forms in the slowly-cooling glass of a volcanic lava, the rain-drop in the wet sand, the foot-print in the clay, or the fragment of shell or bone, will be the letters of the geologist's vast unknown alphabet. The chemist may form laboratory-compounds by processes similar to those by which natural minerals have originated, or the comparative anatomist may reconstruct fossil animals from a few bones or teeth, just as the linguist reconstructs a language from a few fragmentary inscriptions. As, however, history takes us back into a mythical or semi-mythical period without beginning, so the oldest rocks which the geologist can examine tell him little or nothing as to the origin of the earth, but point rather to the former existence of other still earlier rocks now destroyed. Their materials have been reassorted or used again, much as those palimpsest parchments on which some more modern writing hides an effaced original. The rocks that do remain never contained more than a partial representation of the life or other conditions of the period in which they were formed. The perishable algae, fungi, and mosses of former periods, the birds of the air, and many of the plants and animals that perished on dry land, where no sediment was accumulating, have left but few traces of their existence. The rocks, which may contain many fossils still unknown, have as yet in many parts of the world not been searched; and wherever we do examine them we find abundant evidence of much destruction having taken place. The waves of the sea or the action of frost and rain have reduced many rocks and their contained fossils to powder; and solution by percolating water, or crystallisation set up by pressure or by the heat of molten lava may have obliterated the fossils in other cases. This is what is meant by the *imperfection of the geological record*.

Just as there are perhaps six chief points of view from which a student of architecture might examine some historic ruin or building, so there are six main divisions to geological science. As he might take a wide view of the general relations of the building to the surrounding landscape or perhaps of the action of a smoky atmosphere in corroding its stonework, so in what is known as *Cosmical Geology* the geologist considers the earth as a planet, and the influence upon it as a whole, of various agents external to itself, such as the attractive influences of the sun and moon, producing the variations of seasons and tides (q.v.). This subject is, of course, largely identical with that of Astronomical or Mathematical Geography (q.v.); but it also includes several other important but largely hypothetical topics, such as the causes of the Glacial Period (q.v.) and other climatic variations in past times, the Nebular Hypothesis (q.v.), tidal retardation, and the probable age of the earth. With regard to this last question it may be as well to mention here that,

though geologists are unable to say anything in the least definite as to a chronology measured by year it is admitted on all hands that even since the appearance of life on the planet millions of years at least, have elapsed; but here, as wherever the science ceases to be purely observational, it is imperatively necessary to test every hypothesis by its agreement with ascertained facts.

The architectural student again might examine the materials used in the construction of the building, tracing the quarries whence the stones, slate or brick-earth was dug, or the forests where the timber was felled. In the department of *Petrography* similarly the geologist deals with the rock (q.v.) or solid substances of which the earth is composed from the point of view of their mineral constitution. Mineralogy (q.v.) is practically only a subdivision of petrography; but of the thousand of known minerals the geologist is chiefly concerned with only a comparatively small number, such as the essential and more commonly occurring accessory rock-forming minerals, the metalliferous ore and their associated veinstones. Rocks are petrographically examined partly by chemical analysis but mainly by the study of transparent slices under the micro-polariscope. [Rock.] Many of the chief groups of rocks, such as clay, sand, limestone, granite, coal, etc., are dealt with separately.

Thirdly, as a building might be investigated from an engineering standpoint, as to how the stone beams, or girders have been raised, and how they have withstood the ravages of time, so in *Dynamical Geology* the agencies which have formed rocks in the past are studied mainly in the light of those which are now modifying rocks or forming new ones. Most of these agencies form the subject of Physical Geography (q.v.), and are here treated separately, such as wind, frost, rain, rivers, lake, glaciers, the sea, and living beings. This last agency is so important, or rather the evidence of fossils (q.v.) as to geological history is so valuable, that it is often treated as a main division of geology under the name of *Paleontology*, the "science of ancient living beings," with two subdivisions *Paleobotany* and *Paleozoology*. Though these subjects are mainly but a part of Botany (q.v.) and Zoology (q.v.), the facts that many fossils belong to types now altogether extinct, and that their very partial preservation necessitates methods of study entirely distinct from those employed in studying living beings, justify their being considered as distinct discipline.

Fourthly, the purely architectural point of view that studies "style," how the materials are massed, the bricks bonded, the arches described, and the mouldings grouped, gives a name, hardly as yet naturalised from the German, to the division *Geotectonic*, the architecture of the earth, or study of rock-masses. This department deals with the stratification of sedimentary rocks, their folding faults (q.v.), and other deformations, the intrusor or other modes of occurrence of igneous rocks, with joints (q.v.) and with the cleavage, foliation, and other massive structures of metamorphic rocks.

So again, as the old building may be seen to be the work of many ages, often partially destroyed



NAMAD SHALE AND ASHY SLATE.
GEOLOGY.

1. SLATY STRATA—LOWER SILURIAN.
2. ASHY STRATA.
3. FELSPATHIC LAVAS.
4. ERUPTIVE STRATA (GREENSTONE OR DIORITE).

▼

and rebuilt in differing styles and revealing much of the history, social habits, religion, and general life of the times in which it was erected, so the rocks built up, disintegrated, and redeposited, with the fossils enclosed in them, like ancient coins placed under some foundation-stone, give us a *Historical Geology*, which endeavours to reconstruct the physical history of the earth and its inhabitants. This is so largely based on the fossiliferous stratified rocks that it is often termed *Stratigraphical Geology*. Leaving speculations as to the origin of the world to *Cosmogony* (q.v.), it endeavours to trace the physical geography of each successive age in the past. Though it is now recognised that there have been few, if any, great breaks of a universal character in the gradual succession of rock-formation and of animal and vegetable life on the globe, it is still convenient to divide the earth's story into periods, just as we divide history into Ancient, Mediaeval, and Modern, or the latter in England into the Tudor, Stuart, and Hanoverian periods. The main divisions, as adopted and separately explained here, are :—

Tertiary or Cainozoic	{ 15. Pleistocene { Recent or Post-glacial. 14. Pliocene or Crag. Glacial.
Secondary or Mesozoic	{ 13. Miocene. 12. Oligocene. 11. Eocene. 10. Cretaceous.
Palaeozoic—	{ 9. Jurassic. 8. Triassic.
Upper	{ 7. Permian. 6. Carboniferous. 5. Devonian and Old Red Sandstone.
Lower	{ 4. Silurian. 3. Ordovician. 2. Cambrian.
Azoic	1. Archaean.

Lastly, as we may imagine our architect sketching a bit of the building here or there, which brings out some detail of style or construction, or another that has some historical association, so the department of *Physiographical Geology* deals with the application of the study of the rock-masses, of the agents that modify them, and even of the effects of their mineral composition and age, to the explanation of the present landscape-features of the surface, discussing why we have a plain there, why that mountain-range has so serrated an outline while these hills are rounded, why this coast is precipitous and that forms a shelving bay, why this river cuts a ravine and that one forms a delta.

Geomancy. [DIVINATION.]

Geometer Moths, or **GEOMETRÆ**, a subsection of moths, characterised by the fact that the larva have only ten legs—viz. the six true legs and two pairs of prolegs. These correspond to the third and fourth pairs, as the first and second pairs of prolegs are undeveloped. The name is derived from the peculiar character of the gait; the prolegs are at the hinder end of the body, and the true legs are at the front, the caterpillar, therefore, attaches itself by its front legs, and then brings forward the prolegs, the body being bent up into a graceful arch; having secured hold with its prolegs, it then

loosens the hold of the legs, and straightens out the body.

Geometrical Mean of two numbers is a number, whose square is the product of the given numbers. It is thus obtained by multiplying the two given numbers together and taking the square root of the product. The geometrical mean of 4 and 49 is thus 14. In algebra the geometrical mean of two numbers a and b is \sqrt{ab} . In Pure Geometry the geometrical mean of two lines is a line the square on which is equal in area to the rectangle contained by the two given lines. Euclid gives a construction for obtaining this mean.

Geometrical Progression is a series of numbers, each one of which is obtained from the preceding by multiplying it by a constant quantity. Thus, if we settle 3 as the first term of the series and 4 as the constant ratio just mentioned, the series will be—

$$3, 12, 48, 192, 768, \dots$$

each term of which is 4 times the preceding term. If the constant ratio is $\frac{1}{4}$ and the first term 48, the series becomes—

$$48, 12, 3, \frac{3}{4}, \frac{3}{16}, \frac{3}{64}, \dots$$

each term being one-quarter of the preceding term. There are definite rules for the summation of any number of terms in such a series. If the constant ratio is less than 1, the sum of an infinite number of terms is finite, and approaches a definite limit; thus—

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots \text{ to infinity}$$

approaches indefinitely near to 2.

Geometry is the study of the properties of space. It is probable that geometry was first studied by the Egyptians, there being manuscript evidence dating from 1700 B.C. Pythagoras, living in the 6th century B.C., founded a school of geometers, who were well acquainted with the matter which later formed the substance of Euclid's first two books. The metrical connection between the three sides of a right-angled triangle is known as "Pythagoras' Theorem." Eudoxus was the originator of the theory of proportion. Menæchmus discussed the conic sections. The conchoid (q.v.) is due to Nicomedes. Euclid (q.v.), about 300 B.C., wrote his *Elements of Geometry*, which has been retained till the present day as an introduction to the study of geometry. Archimedes of Syracuse, living in the 3rd century B.C., studied metrical properties of the conic sections, conchoids, and of various polyhedrons. Apollonius wrote a treatise on the conic sections about 200 B.C., and Ptolemy was almost as famous a geometer as an astronomer. Very little was done during the first part of the Christian era, the introduction of modern geometry dating from the year 1600. Analytical Geometry was invented by Descartes in 1637. Newton's *Principia* is marvellous from the geometrical point of view, so much being done by aid only of those geometrical facts that were known to the ancients. The greatest geometers of modern times have been Monge, Möbius, Steiner, and Chasles.

There are four geometrical entities with which we believe ourselves acquainted—points, lines, areas, and volumes. Various geometers have given meanings to these four entities, but they are best defined by the dimensions that are necessary to express them. As Euclid says, “a point is that which hath no parts and which hath no magnitude;” it is of zero dimension. A line is determined by length only; it is of one dimension, and it may be regarded as being generated by a point moving from one extremity to the other. A point in thus moving occupies an infinite number of different positions, from which we see that the line may be regarded as being composed of an infinite number of points in series. An area has length and breadth; it has two dimensions; it may be generated by a moving line, and may similarly be regarded as being composed of an infinite number of lines in series. Finally a volume is determined by length, breadth, and thickness; it has three dimensions, and may be traced out by a moving plane. It may be here remarked that a geometrical entity of the fourth dimension might, from analogy, be expected to be bounded by volumes, and to be traced out by a moving volume.

Geometry is divided into various branches, depending upon special properties of these entities.

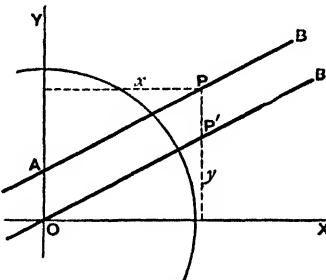
Plane Geometry treats of points, lines, and areas, which lie in a plane, which is a figure such that all the points in the line joining any two points in the plane, must lie wholly in the plane. Our notions of the meaning of a straight line are derived from experience, and it cannot be simply defined.

Solid Geometry treats of figures that are not contained by a plane; it does not only include the study of solids, but also of non-planar systems of points and areas. In Euclid's system *Plane Geometry* is discussed in his first six books; *solid geometry* in the eleventh and twelfth books.

Projective Geometry relates to figures obtained when a point is projected or thrown in a straight line from one position to another, the direction in which it is projected being determined by a point through which it is made to pass. A physical application of Projective Geometry is given in the theory of shadows, the edges of which will be seen to represent the position of projected rays of light. Projective Geometry is most studied in England as *Descriptive Geometry*, which aims at exact representation of plane aspects of solids. Thus, in engineering, a machine is drawn in elevation and plan, which are the views as seen from distant points vertically above it and in a horizontal plane. Near aspects of such solids will be in many respects different, and are studied in *Perspective*.

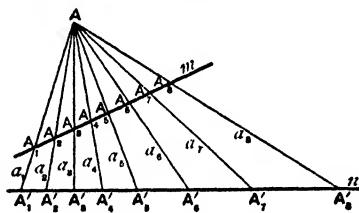
Analytical Geometry expresses the positions of points in various figures by their distances from given lines or given planes. Thus, the point P in the plane of this paper may have its position determined by its vertical distances from two given lines OX and OY. These distances are called coordinates of the point, the given lines being called the axes of the co-ordinates. Its distance from OY is generally called x , and from OX y . The x and y of every point in a given straight line follow a definite law; thus, if x is 2 inches, y has a fixed

value. If the line passes through the point O, which is called the *origin*, the ratio $\frac{y}{x}$ for every point in the line will be always the same. The

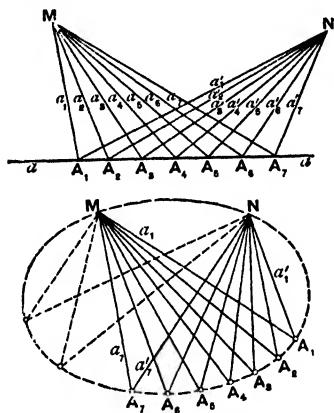


CO-ORDINATE SYSTEM IN ANALYTICAL GEOMETRY.

expression of this fact algebraically gives what is called the *equation* to the straight line. It may be, for instance, $\frac{y}{x} = 2$, or $y = 2x$. Other lines in the plane also have their equations, which become more complex when the line becomes more irregular. All the conic sections, including the circle, are expressed by equations of the second degree (q.v.) in x and y . This fundamental property is often taken as a convenient definition of a conic



$A_1, A_2, A_3 \dots A_8$ in Fig. 1 be a series of points in the line m , and let these be projected from a point A to the positions $A'_1, A'_2, A'_3 \dots A'_8$ in the line n . In the given positions the lines joining $A_1A'_1, A_2A'_2, \dots, A_8A'_8$ all pass through the point A , and, therefore, may be said to determine it. But if m and n be placed in any other position in the plane such as that shown in the second figure, the lines $A_1A'_1$, etc., are seen to form the envelope (q.v.) of a curve. This curve is always a conic section, whatever be the position of the lines m and n ; and by the principle of duality (q.v.), which applies extensively in nonnumerical relations



PROJECTIVE GEOMETRY, FIGS. 3 AND 4.

in geometry, interchanging the words point and line in the above explanation, we derive the following method of getting a conic section:—Let $a_1, a_2, a_3 \dots$ in Fig. 3 be a series of lines through the point M . Let $a'_1, a'_2, a'_3 \dots$ be a series of lines through a point N , such that the points determined by (the intersection of) a_1 and a'_1 , of a_2 and a'_2 , a_3 and a'_3 , etc., lie in a line a . Next let the two sets of lines through M and N be displaced in any way in the plane, as shown in Fig. 4; then intersections of a_1 and a'_1 , of a_2 and a'_2 , etc., determine points on a conic. This method of studying conics is not so much known in England as it deserves, but is by far the most rational and comprehensive.

George, St., the patron saint of England, was a Roman military officer, born of a Christian family, who served with distinction under Diocletian. When the Emperor determined on the persecution of the Christians, George of Cappadocia remonstrated with him, and upon the failure of his remonstrance resigned his commission. He was arrested, and upon his refusal to renounce Christianity was put to death with torture in 303 A.D. He is honoured as a saint in the Roman Church, and is an especial favourite in Spain, and the Greek Church also has canonised him. His feast-day is the 23rd of April. Some confusion as to his life and deeds arose from the fact of his being confounded with a certain heretical archbishop of the same name. The Venerable Bede says he was

martyred under Dacian, King of Persia. The dragon with which he is generally connected came into the story later. St. George was a favourite saint of Richard Coeur de Lion, and the Council of Oxford in 1222 made his day a national festival, but it was Edward III. who made him the patron saint of England. The republics of Genoa and Venice were under the protection of St. George, and he is much reverenced by the Oriental churches.

George I., King of Great Britain, son of Ernest Augustus, Elector of Hanover, was born in 1660. In 1682 he married his cousin, the Princess Sophia Dorothea of Zell, but she was divorced in 1694, and during the rest of her life was confined in the castle of Ahlden. George became Elector of Hanover in 1698, and commanded the Imperial forces in the war with France. On the death of Queen Anne, in July, 1714, he was proclaimed King of Great Britain and Ireland, in accordance with the Act of Settlement. His arrival in England was followed by the formation of a Whig Ministry, and the Whigs remained in office throughout the reign. In 1715 the Jacobites made an abortive attempt at insurrection, which was suppressed by the defeat of the Earl of Mar at Sheriffmuir (November 13), and the surrender of Forster at Preston on the same day. This rebellion led to the passing of the Septennial Act in 1716. [ENGLAND.] In 1720 the South Sea Bubble (q.v.) involved thousands of families in ruin. George I. was a man of coarse tastes and immoral life. He could not speak English, and took little interest in English politics, leaving the conduct of affairs to Sir Robert Walpole (q.v.), who became Premier in 1721. Most of his time was spent in Hanover. He died at Osnabrück, whilst returning thence, on June 9, 1727.

George II. was born in Hanover in 1683, and succeeded his father in 1727. In 1705 he had married the Princess Caroline of Anspach. The Whig Administration of the preceding reign was continued. The period was one of political stagnation, but of great material prosperity, for Walpole took an enlightened interest in the progress of trade. His policy of peace and retrenchment was thwarted by a union of the discontented Whigs with the Tories, led by Bolingbroke, which was supported by Frederick, Prince of Wales, who had quarrelled with his father. Walpole was forced into a war with Spain in 1739, and finally driven from power in 1742. The struggle with Spain and France was continued during the Ministries of Lord Wilmington (1742-43) and Henry Pelham (1743-54), and was carried on with vigour during the Seven Years' War (1756-63) by William Pitt (q.v.), who was Secretary of State in the Ministry of the Duke of Newcastle. The victory over the French at Dettingen (1743) was the last battle in which an English sovereign was personally engaged. A Jacobite rising in 1745-46 ended in the defeat of the Young Pretender at Culloden. The coarseness and brutality which characterised the social life of the time were to some extent diminished through the religious and philanthropic efforts of John Wesley (q.v.) and his associates. Neither the material prosperity of the reign nor the military

lustre which the victories of Clive (q.v.) and Wolfe (q.v.) shed over its closing years can be in any way ascribed to the personal influence of the king. He died on October 25, 1760.

George III., the eldest son of Frederick, Prince of Wales, who died in 1751, was born in London on June 4, 1738. His health was always feeble, and as he grew up it became evident that he was weak in mind as well as in body. He was brought up by his mother, to whom he owed the notion of making his power absolute and using it for the welfare of his subjects. His political mentor was Bolingbroke (q.v.), the author of the *Patriot King*. On October 25, 1760, he succeeded his grandfather, George II. In the following year he espoused the Princess Charlotte of Mecklenburg-Strelitz. George at once exerted himself to end the war with France, and thus remove an obstacle which threatened the establishment of his supremacy. This policy was strongly opposed to the feeling of the country. The Peace of Paris was signed, but Lord Bute, a royal favourite, who had succeeded the Duke of Newcastle as Premier (1762), was driven from power by the popular clamour in 1763. Foiled in his first effort, the king attempted to realise his aim by making use of the mutual jealousies of the various Whig sections. Successive Whig Ministries were formed under George Grenville (1763-65), Lord Rockingham (1765-66), and the Duke of Grafton (1766-70). This period was marked by the successful assertion of important rights—the freedom of the Press, freedom of Parliamentary election, the publication of Parliamentary debates—through the agency of the popular champion, John Wilkes (q.v.). It was also during these years that a feeling of hostility was aroused in our American colonies by the imposition of unconstitutional taxes. In 1770 Grafton was succeeded by Lord North, but he was merely a tool in the hands of the king, who bribed members of Parliament to vote as he wished, and reserved preferment in Church and State, in the army and the law, for those whom he considered his "friends." In spite of the remonstrances of Chatham, the resistance of the American colonists was regarded as rebellion, and a war broke out (1775) which ended in the discomfiture of the royal troops and the recognition of American independence (1782). While America was thus slipping from our grasp, the British power in India was being established under the able administration of Warren Hastings (q.v.) (1773-85). Meantime Lord North had been forced to resign, and, after a short-lived union of the Whigs under the Marquis of Rockingham (1782), Lord Shelburne, who represented the views of Chatham, became Premier, with the younger Pitt as Chancellor of the Exchequer. The Shelburne Ministry was overthrown by an unprincipled coalition of the Tories under North, with the disaffected Whigs who rallied round Fox, under the nominal leadership of the Duke of Portland. Fox was disliked by George III., who believed that he exercised a pernicious influence over the Prince of Wales, and, after his India Bill had been thrown out by the Lords, he and his colleagues were dismissed (1783).

Pitt then became Prime Minister. Throughout his long tenure of office he was a consistent Tory, and aimed at strengthening the power of the Crown, although the king was incapable of appreciating his far-reaching constitutional aims. In November, 1788, the king was stricken with madness, but he recovered in the following February. The universal joy expressed at the thanksgiving ceremony at St. Paul's showed that he had completely regained his lost popularity. Although strenuous in his efforts to maintain peace, Pitt was in 1793 forced into war by the aggressive attitude of the French revolutionary government. His policy was approved by the king, who sympathised with the misfortunes of the French monarch. George also regarded the Act of Union (1800) with much favour; but when Pitt attempted to follow up this measure by removing the political disabilities of the Irish Roman Catholics the king rejected the proposal on the ground that he "could not break his coronation oath," and Pitt was forced to resign (1801). After a short administration under the incapable Addington, during which the Treaty of Amiens was concluded with the French Republic, Pitt returned to power in 1804 to carry on the war against Napoleon. On his death in 1806 the danger from France led to a temporary union of parties, but the "Ministry of All the Talents," headed by Grenville and Fox, adopted a policy too Liberal for the king, and was dismissed in 1807. The Government again became Tory, and remained so for the rest of the reign, the Premiers being the Duke of Portland (1807-9), Perceval (1809-12), and Lord Liverpool (1812-27). In 1810, the king, overcome with grief at the death of his favourite daughter, the Princess Amelia, became hopelessly insane, and in 1811 was declared by Parliament incapable of ruling, the Prince of Wales assuming the royal functions as Prince Regent. The second war with France—in which the victories of Wellington were a source of as much glory to England as those of Nelson had been in the previous struggle—was brought to a close in 1815. The closing years of the reign were marked by a spirit of discontent among the labouring classes, which manifested itself in an agitation for the "radical reform" of the Constitution. The foolish violence with which all public expression of opinion was repressed by the Government led to fatal results in the Peterloo Massacre at Manchester (1819). George III. died on January 29, 1820. His private life was blameless. Unlike his predecessors of the same name, he was an Englishman in character and temperament as well as by birth and education. He was well-meaning, though narrow-minded and bigoted, and was greatly attached to his native country.

George IV., eldest son of George III., was born in London on August 12, 1762. Naturally prone to vice, he broke loose in his nineteenth year from the restraint in which he had hitherto been held, and entered on a career of reckless dissipation. At the same time, out of a spirit of opposition to his father, he began to associate on friendly terms with the Whig leaders, Fox and Sheridan. At the

age of 20 he secretly married Mrs. Fitzherbert, a Roman Catholic widow, thereby forfeiting his title to the throne, in accordance with the terms of the Royal Marriage Act of 1772. He disowned the marriage, however, and in 1795 was persuaded to marry the Princess Caroline (q.v.) of Brunswick—who died in 1821—Parliament undertaking to pay his debts and increase his income. He ascended the throne on the death of George III. on January 29, 1820. During the reign of George IV. the Government remained in the hands of the Tories. Lord Liverpool, who resigned in 1827, was succeeded by Canning (1827), Lord Goderich (1827–28), and the Duke of Wellington (1828–30). The king opposed the Catholic Relief Bill, but was finally induced to consent to it by the representations of the Duke of Wellington (1829). He died, worn out by his debaucheries, on June 26, 1830.

George V., KING (*b.* June 3, 1865), second son of His late Majesty King Edward VII. By the death of his elder brother, Prince Albert Victor, Duke of Clarence (Jan. 14, 1892), he came into the direct line of succession. He was early intended for the Navy, and in 1878 began his naval career as a cadet on the *Britannia*. Two years later he laid the foundation to his right to be considered the most travelled monarch of the world by starting on a cruise in the *Bacchante*, during which he was made midshipman. The itinerary of this cruise was comprehensive, including South Africa, Australia, the West Indies, China and Japan. Before returning, a tour was made through the Holy Land. His interest in naval technique was intense and practical, and he learned every detail of his profession. His steps of promotion were: Sub-lieutenant, 1884; Lieutenant, 1885; Commander, 1891; Captain, 1893; Vice-Admiral, 1903; Admiral, 1907. He married, on July 6, 1893, Princess Victoria Mary (*b.* May 26, 1867), only daughter of the Duke and Duchess of Teck. His Majesty has issue five sons and one daughter: Their Royal Highnesses Prince Edward Albert, born on June 23, 1894, heir to the Throne; Prince Albert Frederick, born 1895; Princess Victoria Alexandra, born in 1897; Prince Henry, born 1900; Prince George, born in 1902; and Prince John, born in 1905.

On the accession of Edward VII. to the throne in 1901, George retired from active naval service, and in March started on an Imperial tour through the Oversea Dominions of the Crown. The Duchess of York accompanied him. They visited Ceylon, Singapore, Australia, New Zealand, South Africa, and Canada. Returning in November of the same year he was created Prince of Wales. His notable "Wake Up, England!" speech was delivered in the Guildhall at this time. Another momentous tour was undertaken in 1905–6 to the Empire of India, when the principal cities were visited. In addition to these especially notable journeys, His Majesty has toured in Ireland (1897 and 1899), and has visited Egypt (1888), Russia (1894), Berlin (1902), Vienna (1904), Canada (1908), Germany (1908), making, it is computed, a travelled aggre-

gate of 150,000 miles. Princes Edward and Albert, his eldest and second sons respectively, are being trained for the Navy. On the demise of the Crown by the death of Edward VII., on May 6, 1910, he succeeded to the Crown, and was proclaimed King three days later.

George, LAKE, also called Horicon, is in the E. of the state of New York, and forms the headwaters of Lake Champlain. There are hundreds of islands in it, and on the shores are some favourite summer resorts of the New Yorkers. The lake is 32 miles long, and near it was fought a famous battle in 1755 in which the French were beaten by the English, Indian allies taking part on both sides. Fenimore Cooper has utilised the lake for some of his most striking scenes.

Georgetown. 1. The port of entry for the district of Columbia, United States of America, is on the left bank of the Potomac, $2\frac{1}{2}$ miles N.W. of the capital, and now forming part of the city of Washington. There is an old-established Roman Catholic College here, and among the many industries the mills form a conspicuous feature. An aqueduct 1,446 feet long carries the Chesapeake and Ohio Canal over the river.

2. The capital of British Guiana—called under the Dutch régime Starbrock—is in the county of Demerara, on the Demerara river, 1 mile from the mouth. It is prettily situated, and has wide, straight streets, with canals in the centre, and the houses are for the most part surrounded by trees and built upon piles, and have open painted verandahs. By the river-side is a plain, unornamented street, which constitutes the business quarter. Among the public buildings is a large courthouse (built in 1834), cathedral, hospital, and barracks. The water is partly supplied by canals from a distance and partly by artesian wells. The harbour has a lighthouse.

Georgia, one of the 13 original states of North America, is on the Atlantic coast, having Tennessee and North Carolina on the N., Florida on the S., South Carolina and the ocean on the E., and Alabama on the W. It is 320 miles long by 256 broad, and contains 59,500 square miles. On the coast are fertile islands separated from the shore by lagoons and sounds. To the low-lying coast succeeds a sandy plain sloping up to a hilly and mountainous district, which is fertile and healthy. Then comes a plateau of 60 or 70 miles broad, leading up to the Appalachian Chain, which passes through North Georgia. The chief rivers are the Savannah, Ogeechee, Altamaha, Santilla, and St. Mary, the Chattahoochee (forming part of the Alabama frontier), the Flint, and tributaries of the Suwanee. The mainland has 128 miles of coast, but there are few harbours except at the mouth of the rivers, the chief being St. Mary's, Brunswick, Dacien, and Savannah. Until 1729 the district was occupied by the Cherokee in the N., and the Creeks in the S. In that year the land was surrendered by treaty, and in 1732 General Oglethorpe, with Government and public aid, founded a colony among the Indians. There are 7,200 miles of railway in the State. The

population, which in 1800 was 160,000, was given in 1908 as 2,500,000. The entire State is under Prohibition (enforced teetotalism, as voted for by a majority).

Georgians, the principal branch of the South Caucasian group. [CAUCASIANS, III.] They are the Grusians of the Russians, both of these terms having reference to St. George, patron saint of the Georgian Christians. The native name is Kartveli, which occurs in the oldest chronicles under the form of Kartlosi—that is, descendants of Kartlos, one of the legendary national patriarchs, founder of the Georgian nation. During the flourishing period of their history the Georgians occupied a vast domain along the southern slopes of the Caucasus; but they are at present mainly confined to the Russian government of Tiflis, which roughly corresponds to the old kingdoms of Karthalinia and Kakhetia. It is estimated that the Georgian-speaking communities of this region number over 300,000; the Mingrelians, Imeritians, Pshaws, Khevsurs, Lazes, and others of kindred speech, nearly 700,000; total South Caucasian family, about 1,000,000. The Kartli (Kartuli) or Georgian language is highly agglutinating and very harsh, with a surprising accumulation of consonants, as in *Mtkhet*, the name of the old capital of Karthalinia. The Georgians rank physically amongst the finest races of the Caucasus, and they were taken by Blumenbach as the type of his Caucasic division of mankind. They are of tall stature, shapely figure, well-marked regular features, with black hair and eyes, large nose, often aquiline, giving them somewhat of a Jewish look. The Georgians were formerly subject chiefly to Persian influences, as shown by the national costume, which is still essentially Persian; but since the Russian conquest Persian have yielded to Slav influences, and during the 19th century European culture made considerable progress amongst all classes of Georgian society. The national Church does not form a separate rite, like the Armenian, Coptic, Greek, and others; hence most of the Georgian Christians recognise the Armenian patriarch, while a few are "Uniates"—that is, united to Rome.

Geotropism, a term applied in vegetable physiology to the effect of gravitation (q.v.) upon the direction of growth. Growth towards the centre of gravity, which is characteristic of roots, is termed *positive*; that away from the centre of gravity, characteristic of stems, *negative* geotropism. Leaves (q.v.), especially those that are flattened and differ in the structure of their upper and under surfaces, are commonly *dorsiventral*, placing themselves, that is, at right-angles to the direction of gravity by what is termed *diageotropism*. To demonstrate that the force directing the growth of roots and stems is gravitation, and to measure the intensity of this tendency to *rectipetality*, or growth in a straight line, an apparatus known from its inventor, Thomas Andrew Knight, as *Knight's machine*, is employed. It consists of a wheel, which can be rotated in a horizontal or in a vertical plane, or with an alternating or rolling

motion, round the edge of which seedlings are planted, so that when it is rotated centrifugal force is substituted for gravity. On this machine, if moving vertically or horizontally, roots tend to grow outwards and stems inwards; but with the rolling or alternating movement they grow indiscriminately.

Gephyrea, a class of worms, of interest owing to the many theories that have been suggested as to their true affinities. They are cylindrical or almost so, and are not marked off into distinct rings or segments like the earth-worms, etc. The anterior part of the body is provided with tentacles, or is prolonged into an extensible proboscis (prostomium); in either case the whole front of the body may be withdrawn into the animal. There may be a pair of hair-like setæ at the anterior end of the body, and in some cases also one or two rings of setæ. The mouth is situated at the base of the proboscis, and the anus opens either at the extreme hinder end of the animal or on the dorsal aspect of the body near the anterior end. The nervous system consists of a band round the pharynx, from which a ventral cord runs backward through the body. There is a large body cavity (coelome), filled with a fluid containing many small corpuscles. Nephridia are present, and may serve as the generative ducts. The sexes are distinct. They are all marine. The class is divided into two groups—the *Gephyrea chatifera*, which have a pair of setæ and the mouth at the posterior end of the body, and the *G. acheta*, in which the mouth is at the extreme anterior end, and the adult has no setæ. The latter group is divided into two families—the *Sipunculidae* and *Priapulidae*: the former has a pair of nephridia, which serve as the genital ducts, while the anus opens on the dorsal side of the animal; in the latter the anus is nearly terminal. The affinities of the Gephyrea have been much discussed, and they have been classed with the Echinodermis through the resemblance of *Sipunculus* to the Holothurians (Sea-cucumbers) and the possession of a water vascular system. By another school they have been allied to the Bryozoa from the resemblance of some of the *G. acheta* to *Phoronis*. [BRYOZOA.] Later researches have, however, shown that the class must be regarded as a degenerate group of worms, in which the normal segmentation has been lost: this is shown by the traces of segmentation represented by the four anterior pairs and one posterior pair of nephridia in some of the *Chatifera* and the rudimentary setæ: but with which division of the worms they must be most closely associated is still doubtful. Thus the males of Bonellia are minute and much like mature Planarians, whereas the characters of *Echiurus* ally it to the Chatopods (q.v.); the family of the *Sternaspidae* may be placed either among the Chaetopods or the Gephyrea. It is probable that several forms now included in this class must be separated from it, and the remainder may then be regarded as a group of degraded worms, allied most closely to the Chaetopoda (q.v.).

Gepidae, a Teutonic people, apparently closely akin to the Goths (q.v.). They are said to have

migrated from the mouth of the Vistula to the banks of the lower Danube. They subsequently fell under the dominion of the Huns (q.v.), and formed part of the vast host which followed Attila in his inroad into Western Europe. After the overthrow of the Huns, they established a powerful kingdom in Dacia, adjoining that of the Lombards (q.v.) in Pannonia. In 566 they were overthrown by the Lombards in conjunction with the Avars, and henceforward disappear from history.

Gera is the chief town of the principality of Reuss-Schleiz, and is situated in a valley of the White Elster, 35 miles S.W. of Leipzig. It was burnt in 1780, and the modern town is well built. Among the principal buildings are the churches of St. Salvator and Holy Trinity, town-hall, banks, central hall, and many schools. The castle of Osterstein—now rebuilt—dates from the 9th century. The chief industries are wool, cotton, silk, and tapestry manufactures, and artificial flower making.

Geranium, the genus giving its name to the order *Geraniaceæ* among dicotyledonous plants. It comprises upwards of 100 species, almost all herbaceous and natives of temperate regions, mainly in the Northern hemisphere, 12 being British. They derive both their scientific and their popular name, which is *Cranesbill*, from the long beak-like carpopore, to the sides of which the five styles adhere until the carpels are ripe. They have swollen stem-joints; stipulate and usually palmately dissected leaves; polysymmetric, pentamerous flowers, with ten stamens united at their bases and hypogynous. Most of the so-called Geraniums of our gardens belong truly to the genus *Pelargonium* (q.v.), are mostly natives of South Africa, and are distinguished by their monosymmetric flowers with an adherent spur to the calyx.

Geranomorphæ, in Professor Huxley's classification, a group of birds containing the Cranes and the genus *Thinocorus*.

Gérard, ÉTIENNE MAURICE, Marshal of France (1773-1852), was born in Lorraine. In 1791 he volunteered for military service, and fought under Bernadotte on the Rhine, in Italy, La Vendée, Spain, and Germany. For his services at Austerlitz he became general of brigade, and he took part in Jena, Erfurt, and Wagram. In 1812 he distinguished himself at Smolensk and the passage of the Beresina. After Napoleon's return from Elba he had a command, and was wounded at Wavre. He did not return to France till 1817. In 1831 he was at the head of an army sent to aid the Belgian Revolution, and in thirteen days drove the Dutch out of Belgium, and in 1832 he captured the citadel of Antwerp. He was War Minister in 1830, in which year he was made Marshal, and again in 1834. In 1835 he became Grand Chancellor of the Legion of Honour, and in 1852 senator.

Gérard, BARON FRANÇOIS PASCAL (1770-1837), was born in Rome, his father being attached to the French embassy there. At 12 years old he came to Paris, and entered the studio of the sculptor Pajou, leaving it afterwards for that of the painter,

Brenet, and then for that of David. He then was in Rome for a time, and then in Paris, where he aided David in his portrait-painting. In 1794 his *Tenth of August* won a prize. In 1795 appeared his *Belizarius*, followed by *Psyche et L'Amour* in 1797. He had now achieved fame, but prosperity did not suit him, and his work degenerated in quality. He painted many notable portraits.

Gerard, JOHN, herbalist and surgeon, was born in 1545. After travelling, possibly as a ship's surgeon, he settled in London, superintending Lord Burleigh's gardens in the Strand and at Theobalds, and afterwards practising as a barber-surgeon and having a garden of his own. In 1597 he published his *Herball, or general historie of Plants*, a translation of Dodone's *Pemptades* (1583), which long remained a popular work, mainly owing to its revision in 1633 by Thomas Johnson. Gerard died in 1612.

Gerenoock (*Lithocranius walleri*), a gazelle (q.v.) from Somaliland. Mounted specimens in the Natural History Museum, South Kensington, show the giraffe-like neck of these animals.

Gerhardt, CHARLES FREDERIC (1816-1856), was born at Strasburg, and educated there and at Carlsruhe. He found great delight in chemistry, and, being disgusted with the commercial life to which he was condemned, enlisted in a cavalry regiment. This, too, did not suit him, and, having been bought out, he studied chemistry under Liebig at Giessen. In 1838 he went to Paris, and here a *Memoir on Essential Oils* attracted notice, and he was appointed Professor of Science at Montpellier. This post he retained till 1848, when he went to Paris till 1855, being afterwards appointed Professor at Strasburg. He could not teach, but was a deep thinker, and his writings have had great influence upon modern chemistry.

Gerizim, a high mountain of Samaria at the W. of a fertile plain, and forming with Mount Ebal the valley of Sichem. The W. side is bold and rugged, but there are many springs, and the other slopes are green and fertile. Upon a plateau is said to have been the Samaritan temple, and on the top are the remains of a fortress and a church. The two mountains are the supposed scenes of the blessings and curses spoken of in the Old Testament.

German Catholics, a religious body in Germany, which seceded from the Roman Catholic Church in 1844. The movement was due to a Silesian priest named Ronge, who wrote a letter to Bishop Arnoldi, protesting against the exhibition of the Holy Coat at Trèves. This letter excited so much sympathy both among Catholics and Protestants that Ronge was encouraged to make a bold attack on papal supremacy and ecclesiastical domination. He aimed at instituting a national church, and denounced auricular confession, the celibacy of priests, and all interference with the right of private judgment. The German Catholic Church was founded in January, 1845, when Ronge was chosen head pastor. Not long before, the "Christian Apostolic Catholic Church," which professed somewhat similar views, had been founded

by J. Czerski, a priest at Schneidemühl, in Posen. At Easter, 1845, a conference of both bodies was held, at which an agreement was come to on points of faith, and it was determined to form a joint organisation. The Bible and the Nicene Creed were alone recognised as standards of belief, and the doctrines of purgatory, transubstantiation, and the seven sacraments were rejected. The movement was at first so successful that it seemed possible it might lead to the re-establishment of a reformed national church in Germany; but its Rationalistic tendencies speedily aroused the suspicions of Protestants as well as the orthodox Catholics; and the Government, fearing it might prove a revolutionary force, took measures to suppress it. Members of the body were subjected to harassing restrictions in Saxony and Prussia, and were actually expelled from Baden and Austria. Its progress was also checked through internal dissensions. Religious fervour gave place to political enthusiasm, and many leaders of the party, including Ronge himself, took a prominent part in the revolutionary movement of 1848. The Conservative reaction which followed was fatal to the hopes of the German Catholics. Ronge was compelled in 1850 to withdraw to London, and did not return to Germany till 1861. By 1858 the congregations had been reduced to one-half their former number, and the movement may now be regarded as extinct, the surviving members having, for the most part, joined some avowedly Rationalistic sect. The Old Catholics (q.v.) are a somewhat similar body of distinct origin.

Germanic Races and Languages. [TEUTONIC.]

Germanicus, CÆSAR, a noted Roman general (B.C. 15-A.D. 19), took his cognomen from his father, Claudius Drusus, the step-son of Augustus. The closeness of the young prince to the throne roused the jealousy of Tiberius. Tacitus is the chief authority for the details of his life. He served under Tiberius, and crushed a revolt in Pannonia and Dalmatia. Augustus gave him the command of the eight legions of the Rhine, and at the emperor's death the mutinous soldiers would have proclaimed Germanicus his successor, but he refused to allow it. He next proceeded to avenge the defeat of Varus by Arminius, and in two campaigns he crushed the Germans. The jealousy of the new emperor caused his recall, but he was so greatly esteemed and honoured by the Roman people that Tiberius sent him to conduct the campaign against the Parthians, assigning him a subordinate, Cn. Piso, governor of Syria, whose duty was to spy upon him and thwart his measures. Germanicus, in his journey, aroused further the jealousy of Tiberius by making a visit to Egypt—a thing explicitly forbidden to Romans of high position by Augustus. He returned to Syria, and there died, as was alleged, by poison. It is only fair to add that Tacitus' impartiality on the matter has been much questioned.

Germanium (Ge) a metallic element discovered by Winkler (1886), in a rare mineral called

argyrodite. It is a greyish-white, brittle metal of sp. gr. 5·47, and has the atomic weight 72·3. If heated in air it forms the oxide GeO_2 , and melts at 900° C. It is unacted upon by most acids. As yet it has not been completely investigated, but the properties mentioned are what had been predicted by Mendeleef (1871) as those of a then unknown metal, which he termed Eka Silicon, and whose existence he prophesied upon the grounds of the Periodic Law (q.v.), to which therefore the discovery of the metal added confirmation.

German Literature. The languages spoken by the numerous tribes inhabiting ancient Germany form an important branch of the Aryan or Indo-Germanic family. From about the commencement of the 7th century, at least, can be traced their division into two groups—Low German and High German, a division which has endured until our own day; for though literary German, the language of the educated classes, is a High German tongue, Low German (to which English and Dutch are closely akin) has retained strength and vitality, and even literary vigour, among the peasantry of North Germany. The existence of a form of speech akin to but differing from both Low and High German is proved by the Gothic translation of the Gospels made by Ulfilas, Bishop among the Goths in the 4th century, and the languages of Denmark, Iceland, and the Scandinavian peninsula form a fourth branch of the same Teutonic group.

Under Karl the Great, who is commonly called Charlemagne, the conversion to Christianity of all German peoples was practically complete (*circa* 800). The only remaining fragment of German literature previous to this period is the *Hildebrandslied*—a single remnant from the time when the heroic saga and the beast-epic (*Thierpos*) flourished in rich profusion, drawing their materials from the echoes of the Great Migrations or from even earlier traditions. This fragment was probably written down at the commencement of the 9th century, possibly under the direction of Charlemagne, who himself commenced a collection of older poems and the compilation of a German grammar. The victories of Charlemagne over the Low German Saxons prevented the definite separation into distinct peoples of the Low and High German tribes, and facilitated the acquisition of a common literature; and the superiority of High German as a literary language is perhaps due to the fact that the tongue spoken at his court was a High German dialect. In the 9th century the word *deutsch* comes into use to express the speech of the German people as distinct from Latin and Romance. The development of learning and culture in the monasteries and the influence of the Church, due largely to Charlemagne, led to the adoption for a time of Latin as the language of literature, and only fragments (such as *Muspilli* and the *Krist* of Otfried)—all of a religious character and probably written by monks—remain of the German productions of the period. One of these, the *Heloland* (*Healer* or *Saviour*) is in a Saxon and Low German dialect. Alliteration is still the characteristic of these writings, but in Latin religious

works the way was being prepared for the adoption of rhyme.

The era of the Hohenstaufen Emperors is marked by the first great golden age of German literature (*circa* 1200). With the Crusades came the development of religious enthusiasm, a widening of ideas, and greater intercourse between the peoples of the western world. Chivalry brought with it new literary materials in its views of religion, love, and war; while the outburst of poetical genius among the troubadours of Southern France exercised a strong influence upon Germany. Among the most remarkable characteristics of the period are the following. (1) The development of the epic in the shape of poetical romances by both popular and courtly singers. The legends of the siege of Troy and of Alexander, of the Arthurian chivalry, and of Roland and Charlemagne form the main materials of these poems, but Heinrich der Glichezare revived the old beast-epic in *Reinhart Fuchs*. Among the most famous writers are Conrad (*Rolandslied*), Heinrich von Veldeke (*Kneide*), Hartmann von Aue (*Arme Heinrich*), Wolfram von Eschenbach (*Parzival*), Gottfried von Strassburg (*Tristan und Isolt*). (2) The compilation of the *Nibelungenlied* and the *Gudrunlied*, the grandest memorials of the older German poetry, in which traditions of the remotest antiquity are combined with the sagas of the *Völkerwanderung* into magnificent epics, an element drawn from Christian and even chivalrous ideas being also represented. In the *Ortrit*, and the poems on the legend of Hugdielrich and Wolfdielrich, the materials are drawn from the sagas of Lombardy. (3) The creation of German lyric poetry by the "Minnesänger," poets of knightly rank, wandering singers who took for their theme the chivalrous passion of love (Minne), and surrounded it with all the charms of a strong and vivid imagination expressed in a wonderful variety of new verse forms. Even the Emperor Henry VI. is named as a Minnesänger. Several of the poets named under (1) belong to this class, but the best known writer of the Minnegesang was the famous Walther von der Vogelweide. Several didactic poems belong to this period, among which is classed the *Sängerkrieg auf der Wartburg*, including the verses said to have been sung at a tournament attended by the chief Minnesänger. The first impetus to prose writing was also given under the Hohenstaufens in the compilation of the *Sachsen-Spiegel* and *Schwanenspiegel*, codes of local laws, and in the religious writings of Meister Eckhart.

The succeeding period was one of decay and of degeneracy among the higher classes. The national horizon was narrowed by the growth of anarchy and confusion; constant struggles for supremacy prevented the Emperors from encouraging literature; divisions in the Church led to the neglect of learning. But by the German people a new impetus was given to poetry. The towns formed the one stable and prosperous element of national life, and here a new class of poets arose. Honourably distinguished from the town-writers who made a trade of poetry, composing in honour of princes and for popular festivals, the "Meistersänger" or workmen-bards were the members of gilds of poetry formed

in imitation of the craft-gilds and governed as to methods of composition by strict codes of rules. The most famous representatives of the Meistersgesang were Michel Behn, Hans Rosenplüt, and later Hans Sachs, the shoemaker of Nürnberg. To this age, too, belong the earliest German dramatic compositions, commencing with representations of Scriptural subjects and developing into the numerous "mysteries" and "Shrove-Tuesday plays." The Limburg and other chronicles were written in prose; and the speculative movement, commenced by Eckhart, was carried further by Tauler and the Mystics. Another marked phenomenon was the outburst of popular poetry in ballads and *Volkstlieder*, admirably reflecting the life and feelings of the poorer classes. The Revival of Learning was not without influence in Germany, and its effects were shown in popular satires against the Church, the aristocracy, and the many vices of the times, such as the *Ship of Fools* of Sebastian Brandt (1494), the sermons of Murner, and the didactic and narrative works of Fischart. Among these works must be mentioned the great Low German poem of *Reincke Vos* (1498), in which the old *Thirrepos* is used as a powerful instrument of satire. To the 15th and 16th centuries belong the most of the *Volkbücher*, collections of popular tales and legends, such as *Tyll Eulenspiegel*, *Dr. Faust*, and *Amadis of Gaul*.

The Reformation marks an important epoch in German literature, characterised by the fixing of the literary language by Luther (1483-1546). By the year 1600 the idiom chosen by him—that of the Imperial and Saxon chanceries—was established as the medium of literary intercourse throughout Germany. His example in using it for his translation of the Bible (1522-34) and many magnificent hymns (Luther may be regarded as the founder of the *Kircheulied*) was followed by the historians, such as Sebastian Franck, by the many composers of hymns and religious lyrics, and the mass of religious writers, of whom the chief were Arndt and Böhme. The influences of the time were, on the whole, favourable to the development of the drama, which received a considerable impetus at the hands of Hans Sachs (1494-1576) the Meistersänger, a voluminous playwright, and through the tour of a troupe of so-called "English players," who brought to bear on Germany the powerful dramatic influence of England.

The period immediately previous to and during the Thirty Years' War (1618-48) was one of complete literary decay, broken at first only by the occasional appearance of religious lyrics. Later, a genuine attempt at revival took place in the foundation of societies for the cultivation of literature such as the "Fruitbearing Society" (1617). Of this the greatest ornament was Martin Opitz (1597-1639), who laid down rules for the writing of poetry in a correct but cold and soulless manner in his *German Poetry* (1624). Opitz, with his follower Fleming, a talented writer of lyrics, Gryphius and the epigrammatist Logan, formed the "First Silesian School." The lowest depths of foolishness and bombast were touched by the "Second Silesian School" of Hoffmannswaldau and Lohenstein. Vigorous prose

was, however, written by Grimmelshausen, whose *Simplicissimus* (1669) is a series of pictures from the Thirty Years' War, and the satirists Moscherosch, Schupp, and Abraham a Sancta Clara. The extravagance of the Second Silesian School brought about a reaction, expressed in the simple lyrical poems of Brockes, Günther, and Weise, and the satires and critical works of Canitz and Warnecke. It was generally felt that poetry must be founded on the study and imitation of nature; but one result of this feeling was an important literary quarrel between the so-called "Leipzig" and "Swiss" schools, influenced by France and England respectively. Gottsched (1700-1766), the leader of the former, exercised much influence upon literary taste and poetical form. In his *Attempt at a Critical Art of Poetry* (1730), and in his dramas, he looked to the great French writers as models. The immediate cause of the quarrel was his attack upon a translation of *Paradise Lost* by Bodmer (1698-1783), who, with Breitinger (1701-1776), laid stress upon the imaginative rather than upon the intellectual side of poetry. The revival of a simple and natural taste was also largely assisted by Haller and Hagedorn, both strongly influenced by England. Among the services of Gottsched must be reckoned the purification of the drama, which he rescued from a state of absolute degradation, looking for his models of excellence, however, exclusively to French examples. During this period German philosophy had made steady progress. The great philosopher Leibnitz had at the end of the 17th century written in Latin, but his theories had been explained and expanded in German by his disciple Wolff. Thomasius, his contemporary, is noteworthy as the first professor who lectured in German and as editor of the first German periodical.

A profound influence was exercised upon Germany by the magnificent achievements of Frederick the Great, and literature now commenced to take its place as an expression of national life and feeling. The literary taste of the king himself was entirely under French influence, and he remained untouched by the newer developments in Germany. His approbation was reserved for Gottsched and for Gellert, the leader of the "Saxon school," composed of a number of young writers who contributed to a literary and critical publication known as the *Bremer Beiträge* (*Bremen Contributions*—founded 1745). Gellert was declared by the king to be "the most reasonable of all German scholars." Gellert's fables, tales, and religious lyrics enjoyed great popularity; and among other members of the school, Rabener, Elias Schlegel, Weisse, and Küstner deserve mention as dramatists and satirists. Gleim, a didactic writer who composed during the Seven Years' War the stirring *Prussian War Songs of a Grenadier*, Uz and Götz, included in the "Halle school," attained some reputation as writers of anacreontic verses. The new patriotic impulse is strong in the writings of Ramiller and of Ewald von Kleist, Lessing's early friend.

We have now arrived at the time when German literature was to shake itself free from the

shackles of narrowness and conventionality imposed upon it by a long period of preparation and imitation, and to exhibit in its second golden age a richness, strength, and variety unsurpassed in modern times. The extraordinary development which took place in the latter half of the 18th century is associated primarily with four great names—Klopstock, Wieland, Lessing, and Herder. By the two former invaluable services were rendered to German poetry in respect of the development of language and metrical form. Klopstock (1724-1803) in his great poem of the *Messiah* and his *Odes* at once reached a higher level by virtue of both subject and treatment, showing the influence of Milton and the great English writers, and obtained prompt response from the deepest feelings of the national religious life, in spite of the occasional unreality which spoilt the sublimity of his works. In strong contrast to him stands Wieland (1733-1813), whose appeals to sentiment and "*Schwärmerei*" were strongly influenced by French and Greek models. The work with which his memory is now chiefly associated is the *Oberon*, but his productiveness was extraordinary, and enabled him to confer a new flexibility upon both language and style in both prose and verse. In one way his influence was injurious, in so far as he introduced a strongly sensuous and epicurean element. Closely related to the works of Klopstock are the writings of Gessner, Lavater, and Jacobi, while Musäus and Heinse show the influence of Wieland. A small group of poets, known as the "Göttinger Hainbund" ("Göttingen Grove League"), stood in strong opposition to Wieland and acknowledged Klopstock as inspirer and master. Of these the chief were Voss (1751-1826), famous for his translations of Homer and for the idyllic poem of *Luisa*, Bürger (1748-94), well known through the celebrated *Lenore*, and many vigorous lyrics and sonnets, Höltig, whose odes and lyrics deal with the charms of country life, Martin Miller, and the two Counts of Stolberg. Claudius also is usually associated with this school.

In the formation of the modern period of German literature, however, the influence of Lessing (1729-1781) is supreme. The founder of modern German criticism, he is also the creator of the modern German drama. His smaller poetical works belong mainly to the lighter anacreontic school, but in *Minna von Barnhelm* he gave vigorous expression to the new patriotic feelings, and by this and other plays, notably *Emilia Galotti*, he placed the drama upon a higher level than it had ever before attained in Germany. But it is upon his critical writings that the fame of Lessing chiefly rests, and through them he opened up a new world of thought—for art by the *Laokoon*, for dramatic criticism by the *Hamburgische Dramaturgie*, for religion by the *Wolfenbüttel Fragments* and the great dramatic poem of *Nathan the Wise*. Lessing's style was a model of clearness and power. Less original than Lessing and narrower in range is Herder (1744-1803), but he did much to awaken a sense for the poetry of nature and of popular life by his *Cid* and the collection of lyrics called *The*

Voices of the Peoples, and to influence the methods of historical inquiry and criticism by his *Ideas towards the Philosophy of the History of Humanity*. Among prose writers of the period were Winckelmann, whose *History of Ancient Art* (1764) inspired the *Laokoon*, the popular philosophers Mendelssohn and Engel, Zimmermann (*Observations on Solitude*), and Möser, the first of the great modern German historians.

The strongly critical views of Lessing found opposition among a band of young writers who looked to Herder as their inspirer, and who conferred upon the decade 1770-80 the name of the *Sturm- und Drang-period* ("Storm and Stress Period"). Lenz, Klinger, Müller, Schubart—would be original geniuses, rebels against the acknowledged canons of poetry and religion—form the connecting-link between the great writers of the earlier period and Goethe and Schiller.

These two great poets in their earlier works gave the finest and the best expression to the period of "Storm and Stress" which was now passing away—Goethe in *Götz von Berlichingen* and the *Sorrows of Werther*, Schiller in the *Robbers* and *Fiesco*; but both soon acquired complete independence and gave full scope to their own creative genius. The influence exercised by them, both independently and in co-operation, was unexampled. Goethe (1749-1832) stands pre-eminent in modern literature, and his wonderful manysidedness and long life enabled him to enrich German literature with works of the first importance in very many branches of composition, dramatic, lyric, epic, critical, narrative, and scientific. Schiller (1759-1805), though inferior to Goethe in imagination and range of sympathy, is no unworthy rival of his fame, and to the period of his classical perfection belong many of the most famous productions of the German muse. The friendship and co-operation of Goethe and Schiller between 1794 and Schiller's death in 1805 strongly influenced the intellectual development of both poets, and form one of the most remarkable phenomena in the history of literature.

The age of Goethe and Schiller was strongly influenced by the philosophical writings of the great Kant, who brought to its highest fame the German school of thought. The later writings of Schiller show many traces of the influence of Kant's *Critique of Pure Reason* (1781), and he applied its principles to esthetics. The intellectual movement commenced by Kant was worthily continued by Fichte, Schelling, and Hegel, and (in a very different direction from the last-named) by Schopenhauer and Von Hartmann. Among prose writers Lichtenberg, Hippel, the great humourist Jean Paul Richter (1763-1825), and the educational reformer Pestalozzi (*Lenaard and Gertrude*—1781), must be mentioned. The stage was for many years to a large extent occupied by the dramas of Iffland and Kotzebue.

An important literary movement dates from the period of Goethe and Schiller's fame—the so-called "Romantic School" (at its height 1796-1800). At first under their influence, then exhibiting a strong reaction against classical form and feeling and a tendency to seek for inspiration in the Middle

Ages and the East, its leading representatives are Hardenberg (Novalis), A. W. von Schlegel, F. von Schlegel and Tieck, author of many tales, novels, and critical works. To the two last-named is due an admirable translation of Shakespeare. The tendencies of the Romantic school were continued by many other writers by Brentano and Von Arnim, who collected the old German lyrics in *Des Knaben Wunderhorn* (*The Boys' Wonder-Horn*, 1806-8) by Hoffman, who dwelt upon the mysterious and darker side of nature, Fonqui, best remembered by his little masterpiece of *Undine* (1813), and Chamisso, the author of *Peter Schlemihl* (1814), and by the dramatists Heinrich von Kleist, Werner, the inventor of the "fate-tragedy," Müller, and Grillparzer.

The patriotic outburst of sentiment during the War of Liberation, which found its expression in prose in Fichte's *Addresses to the German Nation* (1808), was celebrated in splendid lyrics by Körner (1791-1813) and Arndt (1769-1860).

The productive activity of Goethe continued until the close of his life, and we may consider him as the connecting link between the older period and that which commenced with the end of the War of Liberation. As in part belonging to the period of transition may be reckoned also Uhland (1787-1862), one of the greatest modern lyrical and ballad writers, the centre of the "Swabian School" (including Kerner, Schwab, and Mörike), and Rückert (1789-1866), distinguished for his translations and adaptations from Oriental languages. The subsequent period was one of repression and popular discontent. The wretched novels of Claußen were widely read until extinguished by the scathing satire of Hanff (*Lichtenstein*, 1826); and the leading dramatists were Raupach, Auffenberg, and Immermann, the author of *Marienhausen*. A strong revival followed, in which the foremost place is taken by Heinrich Heine (1797-1856)—*Buch der Lieder*, 1827), who as a composer of lyrics stands second only to Goethe and Schiller, and who gave to German prose style new powers of expression. Count Platen takes a prominent place as a finished and talented writer of sonnets and odes; and a school known as "Young Germany," strongly influenced by Heine and of which the chief members were Gutzkow and Laube, attempted to awaken political and social life by their romances and plays.

Among later lyrical writers of note are the Austrian poets, Count von Auersperg ("Anastasius Grün") and Nicholas von Strehlenau ("Leben"), Hoffman von Fallersleben, Emmanuel Geibel, Freiligrath, Hamerling, Jordan, Scheffel, and many others. As elsewhere there has been in Germany a great development of novel-writing, and among writers of fiction Freytag, Scheffel, Ebers, Hahn-Hahn, Lewald, Marlitt, Heyse, Hackländer, Auerbach, Spielhagen, Hauptmann, and many others are well known and widely read. Low German has again produced works of real literary merit in the popular tales and poems of Fritz Reuter, one of the most genuine of German humourists. In dramatic literature the names of repute include Gutzkow, Laube, Grabbe, Hebbel, Halm (Münch Bellinghausen), Freytag, Lindau, Bencilex, Sudermann, etc.

No sketch, however slight, of German literature would be complete without some mention of the immense services rendered by modern German scholars, theologians, travellers, philosophers, historians, and men of science. In travels Humboldt, Leipsius, Schlagintweit, Schweinfurth; in philosophy Überweg, Zeller, Fischer, Lange; in history, Niebuhr, Ranke, Mommsen, E. Curtius; in scholarship and philology, Grimm, Dindorf, Lachmann, G. Curtius, Schleicher, Bekker, Boeckh; in theology, Julius Müller, Olshausen, Neander, Baur, Wellhausen; in science Liebig, Helmholz, Virchow - are but a few of the many illustrious names. Selection is, however, almost impossible, and space prevents anything approaching to a full catalogue from being here given.

It may be useful to remember that German literature exhibits two periods of exceptional richness and vigour - that of the Hohenstaufens (*circa* 1200), and that of Goethe and Schiller (*circa* 1800). Each of these is preceded by a period of poverty and decay, the one in the 10th, the other in the 16th century. It has been suggested that the year 600 may be taken as about the centre of another important period - that of the heroic sagas and popular epics of which, however, only the one fragment of the *Hildebrandslied* has reached us.

German Silver, or NICKEL SILVER, is an alloy of nickel, copper, and zinc. The proportions in which these several constituents are present vary greatly with the mode of preparation and the use for which the alloy is required. For most purposes an alloy of about 5 to 6 parts copper, 2 to 2.5 parts nickel, and 2 parts zinc is employed. Owing to the very high melting points of the nickel and copper the preparation presents considerable difficulty, and is usually performed by melting the nickel and one-half the copper together, and then adding to the molten mass, under charcoal, an alloy of the zinc with the other half of the copper. When thus prepared it is of a greyish-white colour, is harder than silver, and capable of taking a high polish. It is, however, crystalline, and to get rid of this is heated, hammered, and rolled, after which it can be easily worked. Being much cheaper than silver and not tarnishing easily, it is very largely employed instead of this metal, but it has the disadvantage of being easily attacked by acids. It is also much used as a basis for electroplating, the layer of silver being usually deposited upon German-silver articles.

Germany is the central country of Northern Europe, and is situated between Russia on the east and France, Belgium, and Holland on the west. On the south it is bounded by Switzerland and Austria, and on the north it has towards Denmark a frontier of 53 miles, and a coast-line on the North Sea of 300 miles, and on the Baltic of 830 miles. The term "Germany" is now generally restricted to the German Empire as constituted in 1871, which stretches from long. $5^{\circ} 52'$ to $22^{\circ} 52'$ E., and from lat. $47^{\circ} 16'$ to $55^{\circ} 53'$ N. The population was in 1871, 41,058,792, in 1881, 45,234,061, and in 1905, 60,641,278; the

area is over 211,000 square miles, or about one-sixteenth of the entire area of Europe. Physically Germany is divided into two distinct portions:—(1) the great plain of North Germany, occupying about three-sevenths of the entire Empire, and covered with very recent deposits, with small areas of tertiary and secondary formations; (2) Central and Southern Germany, consisting largely of high tableland and mountain intersected by occasional plains, such as that watered by the Rhine.

The oldest rocks are the granites and schists of Bavaria and Bohemia. Triassic rocks occupy a vast area, and the Devonian system has a large extension. Igneous rocks are found in the Eiffel, Siebengebirge, and other mountain ranges. The greater part of Germany belongs to the basins of rivers which drain into the North Sea (Rhine, Weser, and Elbe) and the Baltic (Oder, Vistula, Memel, and Prege), but the Danube flows through Germany for about one-fifth of its course, and drains the larger portion of Bavaria into the Black Sea. About one-half of the entire area consists of arable land, and there are also vast forests. The ordinary cereals are largely grown in the north; the vine and the tobacco and hop plants give rise to considerable industries in the south. Germany is rich in minerals, especially coal, iron, lead, copper, zinc, and the precious metals. The manufacture of cotton, linen, and woollen goods is largely carried on.

History. The first appearance of the Teutonic peoples upon the page of history is in the invasion of Roman Gaul by the Cimbri and Teutones. Half a century after their defeat by Marius, Julius Caesar engaged in the conquest of Gaul, thoroughly subdued the German tribes settled to the west of the Rhine and temporarily united under Ariovitus. From this time the Germans were in close contact with the Roman Empire, and many of them served in the Roman army. But attempts to extend the reality of dominion over them were finally foiled by the annihilation of Varus and his legions by the great patriot Arminius, chieftain of the Cherusci, in A.D. 9, and the subsequent campaigns under Germanicus had little permanent result. Writing in A.D. 98, Tacitus has left us in his *Germania* a detailed account of the formidable nations inhabiting ancient Germany. Living in villages or single homesteads, they were united politically into hundreds and districts (*gauen*) under chiefs who were surrounded by a following of freemen bound to them by ties of personal affection and service. Society was organised into classes—nobles, free-men, *liti* (freemen, but without property in land or share in political life), and slaves. The family relation was of great importance, and the position of women one of much honour. The military force was composed of the entire body of armed free-men, and in peace government was carried on by meetings of all free members of the community.

In the second century the Roman frontier had to be defended against German aggression, and in the fourth century commenced that steady influx into Roman territory of the Teutonic races which was caused by the savage invasions and onslaughts of vast hordes of Huns from Asia. The Slavonic

peoples took part in the movement westwards—the Great Migration or *Völkernwanderung*—and took possession of the German lands left vacant. Single tribes are now heard of no longer, but vast confederations of tribes press upon the Empire and form settlements and kingdoms—Alemanni, Bavarians, Franks, Frisians, Goths, Saxons, Thuringians. Of the monarchies which arose upon the ruins of the Roman Empire the most important was that of the Franks, divided into the Salian and the Ripuarian Franks, settled towards the

crushing defeat of the Saracens at Tours in 731. Besides saving the western world from Mohammedan conquest, he rendered powerful assistance to St. Boniface, the great English missionary, who effected during the eighth century the final conversion of the Germans to Christianity.

His grandson, Charles the Great, or Charlemagne, succeeded in 771 to undisputed authority over all Franks and, by conquest over the Lombards, Bavarians, and heathen Saxons, established one of the great empires of the world. His coronation as



MAP OF GERMANY.

mouth of the Rhine and on the middle Rhine respectively. Contact with the Empire and service in its armies had rendered them familiar with Roman ideas and the kingly power was greater among the Franks than with the other Germans. Under Chlodwig, who in 496 embraced the Christian faith and secured the support of the Church against his Aryan enemies, the whole of Gaul and much of Germany were united under Frankish rule. The old German popular assemblies had now fallen into disuse, and by grants of benefices and fiefs to powerful vassals the rulers had created a new aristocracy, which was especially powerful in the eastern division of the Frankish kingdom—Austrasia. The Merowingian successors of Chlodwig were an evil and feeble race, and under them the "Mayors of the Palace," great officers of the Crown, rose to almost supreme authority among the West Franks. Two of these mayors, Pipi of Heristal and his son Charles, ruled the East Franks also as Dukes, and the latter earned the name of Martel ("the Hammer") by his

Emperor by Pope Leo III. at Rome in 800 was the commencement of the Holy Roman Empire, which existed for ten centuries, and laid the foundation for many developments of later German history. To his encouragement of the Church is due much of the subsequent power of German ecclesiastical princes. He promoted good government by the strict enforcement of justice and by curbing the power of the great vassals. But only Charlemagne could rule his vast possessions. His successor, Louis the Pious, divided them among his four sons, and the result of the family struggles which followed was the separation of Germany from Gaul and of both from Burgundy and Italy at the Treaty of Verdun in 843. A separate kingdom of Germany was then formed under Louis "the German," and although the dominions of Charlemagne were, with the exception of Burgundy, temporarily reunited under Charles the Fat in 884, his deposition in 887 was followed by the final separation of the East and West Frankish kingdoms. The incursions of the Nörsemen were checked in 891 by Arnulf; but

they were followed by the savage attacks of the Hungarians during the reign of Louis the Child, with whom ended the race of Charlemagne in 911.

The royal power had now almost vanished, and the system of granting fiefs had resulted in the formation of a class of powerful local rulers—the Dukes of the great groups or confederations of tribes. The maintenance of central authority at all was probably due only to external danger from Slavs, Norsemen, and Magyars, and even this could not prevent constant warfare between the great feudal lords. Conrad of Franconia, elected by the leading nobles, was unable to enforce his authority, and was, at his own suggestion, succeeded by his great enemy, Henry, Duke of Saxony. A born leader of men, statesman and general, Henry I. (919-936) introduced a new civil and military organisation. He created the burgher class by the foundation of towns, compelling every tenth freeman to labour on their building, and these towns he made the centres for judicial administration, ceremonies and festivals, markets, and trade. He broke the power of the Magyars, subdued Danes and Slavs, and before his death private war had ceased. His son, Otto the Great (936-973), consolidated the royal power, and reduced the great Duchies to submission, keeping them in his own hands or in those of members of his family. In 951 he entered Italy to settle the affairs of the Lombard kingdom, but returned to cope with a revolt terminated only by the vital danger of an invasion by the Magyars, whose power was finally crushed in 955. Crowned Emperor by the Pope in 962, he set an example to subsequent German kings, who claimed the Imperial and Lombard crowns as of right; but the precedent led also to the continued absences of the German rulers in Italy and the severance of their interests from those of their own proper dominions. The sense of German nationality grew in his reign, yet this was accompanied by a weakening of central authority and the development of the power of the great vassals, dukes, and princes ecclesiastical and secular. After his death constant civil war increased their power until their growing independence was checked by Conrad II. (1024-1039), the first of the Franconian Emperors, who rendered the *mediata* nobles, vassals of the great lords, less dependent on their feudal superiors and formed a close alliance with the towns. His son, Henry III. (1039-1056), further strengthened the royal power, put down private war, and in 1043 proclaimed a general peace. His attempted reformation of the Papacy and appointment of four German popes in succession commenced the long and fierce struggle between the Emperors and the Popes. During the minority of his son, Henry IV., the great nobles recovered much of their power. His opposition to the famous decree of Pope Gregory VII. in 1075 against the marriage of the clergy and their investiture by laymen was followed by his summons to Rome, his deposition of the Pope through a synod of German bishops, his excommunication and complete humiliation at Canossa in 1077. The dispute was only settled under his son, Henry V., by a compromise,

the "Concordat of Worms," in 1122, but the power of the Papacy had been enormously strengthened. It had attempted to dispose of the Imperial Crown, and Innocent II. even claimed to have granted it to Lothar of Saxony (1125-1137) in 1133 as to a vassal.

With Conrad III. of Franconia (1137-1152) commences the line of the famous Hohenstaufen Emperors. The two great parties supporting the Pope and the Emperor now first became known as Guelphs and Ghibelinnes (Welfs and Waiblingers). His successor, the great Frederick Barbarossa (1152-1190), was occupied in Italy during long years with the now permanent struggle against the Popes and the Italian cities supporting them. In Germany Teutonic power was extended over the Slavonic countries along the Baltic by Henry the Lion of Saxony and Albert the Bear, to whom was granted the Mark of Brandenburg. Under Frederick II. (1212-1250) the struggle with the Papacy was continued. Sentence of excommunication was launched against him, and a rival king was elected, and his continued absence in Italy led to the utmost anarchy in Germany. Meanwhile the conquest of the Slavonic lands now forming a great part of Prussia progressed steadily under the Knights of the Teutonic Order and of the Order of the Sword.

The period of the Hohenstaufens was one of great brilliancy. Chivalry was promoted in the Crusades, literature was in full bloom in the works of the Minnesänger, Gothic architecture received its finest developments, the towns increased in prosperity, many serfs were freed, and codes of local customs and usages were compiled, such as the *Sachsenspiegel* and the *Schwarzsiegel*. On the other hand, the greater vassals became practically independent, and the principle of inheritance was applied to their lands and offices. The privileges usurped by the ecclesiastical and secular princes were confirmed by Frederick II. in the "Pragmatic Sanctions" of 1220 and 1232, and the right of electing the Emperor was confined to the Seven Electors.

The period of anarchy culminating in the "Great Interregnum" (1250-78) is marked by the formation of the Rhenish Confederation of some seventy leading cities for mutual defence, and of the powerful Hanseatic League.

Rudolf of Habsburg, elected in 1273, revived the royal authority and strictly enforced justice, but his rule was unfavourable to the growing privileges of the towns. In this respect his policy was reversed by his successor, Adolf of Nassau (1291-1298), and by his son, Albert I. (1298-1308), who even befriended the serfs and the Jews. The long struggle between the Empire and the Papacy practically ended under Louis IV. (1314-1347), by the formal declaration of the Electors in 1338 that the Papal sanction was not needed to the election of the Emperor. Public peace was encouraged under Louis IV., and his friendship to the towns was constant. Industry and trade flourished more and more in the cities, and their government was now becoming more democratic through the victory of the craft-guilds over the old patrician families

Charles IV. (1347-1378), the first Emperor who retained his hereditary lands on election, by the "Golden Bull" in 1356 regulated the method of election and confirmed the complete sovereignty of the Electors in their own territories. In 1396 the foundations of Swiss independence were laid in the victory of the "Eidgenossen" over Duke Leopold of Austria at Sempach. In the reign of Sigismund (1410-1437), who united the dignities of King of Hungary, King of Bohemia, and Margrave of Brandenburg, and who was the last Emperor crowned at Rome, the Hussite war, consequent on the burning of John Huss by the Council of Constance in 1415, foreshadowed the Reformation. The Mark of Brandenburg now passed to the Hohenzollerns, under whom it was to grow into the kingdom of Prussia.

The reigns of Frederick IV. (1440-1493), and Maximilian I. (1493-1519), the husband of Mary, the heiress of Charles the Bold, last Duke of Burgundy, bring the Middle Ages to a close. The age of chivalry was ended by the invention of gunpowder and the use of mercenary troops; the realities of feudalism had passed away, the Imperial authority had dwindled to nominal control, and princes and cities had attained independence. But the Imperial dignity was now permanently connected with the House of Habsburg and combined with great territorial possessions. The semblance and, to some extent, the reality of unity were established by the growing use of Roman law, by the constitution in 1495 of an Imperial Tribunal or Court of Appeal (the "Aulic Council"), and by the division of Germany in 1501 and 1512 into "Circles," each with its own "States" charged to carry out the decisions of the Imperial Chamber.

Luther's denunciation of indulgences was made in 1517, but the full storm of the Reformation burst after the accession of Charles V. (1519-1555), who united to the Empire the entire possessions of the kingdom of Spain. At the Diet of Worms in 1521 he took up the defence of the Church, and condemned Luther as a heretic. At the same Diet an Imperial Administrative Council was established, and a "Matricula" drawn up, settling the contingents of troops to be raised by the States, both of which existed until the fall of the Empire. The Reformation now made irresistible progress; a common name, "Protestants," was acquired by the Reformers at the Diet of Speyer in 1529, and a common statement of doctrines, the "Augsburg Confession," was drawn up in 1530. The new and the old religions were put upon an equality by the Religious Peace of Augsburg in 1555, in which, however, the Calvinistic or Reformed Faith was not included. In the fearful struggle which followed the Reformation the Imperial authority was completely ruined. The reaction against the new doctrines, due mainly to the zeal of the Jesuits, gave fresh strength to the Catholic party, the Reformation was stamped out in Bohemia, and complete toleration was not acquired by Protestants (including both Lutherans and Calvinists) until the Peace of Westphalia in 1648.

This was at the close of the disastrous and

merciless struggle known as the Thirty Years' War. The result of the confused period commencing with the abdication of Charles V. in 1555 must be briefly summed up. The Empire in Germany was practically ended and was now attached to the hereditary dominions of the House of Habsburg in Austria. The population of Germany was reduced by more than one-half; industry and trade had almost ceased to exist; enormous territorial losses had been suffered, and France and Sweden had made great acquisitions. Switzerland and the United Provinces were severed from the Empire, and had acquired complete independence. Germany emerged from the war a mere lax confederation of states, whose rulers—a race of absolute and, in most cases, coarse and selfish despots—were recognised by the Prince of Westphalia as independent. Even in the cities government had passed into the hands of local oligarchies. The only bond of union was the nominal authority remaining to the Emperor, and now transferred to the Diet, of passing laws, concluding treaties, and making war and peace. One completely good result of the war was that amid the prevailing anarchy were laid, by Grotius, the foundations of a system of International Law.

The Thirty Years' War was followed by the rise of Prussia. Brandenburg had in 1611 become united to the Duchy of Prussia, part of the possessions of the Teutonic Order, which was in 1657 declared independent of Poland of which it had been a fief, and received further accessions under the Great Elector, Frederick William. It grew steadily in power during the long struggle against the unscrupulous aggressions of Louis XIV., and in 1701 the son of the Great Elector, Frederick I., obtained from the Emperor the recognition of the Prussian Duchy as a kingdom. In 1713 a "Pragmatic Sanction" was drawn up by the Emperor Charles VI. (1711-40), providing for the inheritance of the Austrian dominions by his daughter, Maria Theresa, and this was ultimately guaranteed by the leading Powers. But his death in 1740 was the opportunity of Prussia, where Frederick II., better known as Frederick the Great, had just ascended the throne. He immediately occupied Silesia. Maria Theresa met with enthusiastic support in Hungary, and in 1745 her husband was elected Emperor as Francis I. (1745-65). An interval of peace was followed by the Seven Years' War, at the conclusion of which, in 1763, Prussia was confirmed in the possession of Silesia, took rank as a great Power, and became definitely the rival of Austria in German politics. The partition of Poland in 1772 gave her further territories. Frederick the Great, who died in 1786, though an absolute ruler, exercised his power with a complete absence of selfishness and for the good of his people, and left Prussia a compact, well-ordered, and flourishing kingdom. In 1785 he had formed against Austria a league for the preservation of the Imperial Constitution, the first serious attempt by Prussia in the contest for German supremacy. The French Revolution, with its quarter of a century of constant change and warfare, brought ruin and disaster to the older German states, which fell in succession

before the arms of France and the genius of Napoleon. By the second and third partitions in 1793 and 1795 Poland ceased to exist, and both Prussia and Austria were increased; but in 1801 the French frontier was extended to the Rhine, in 1803 Napoleon seized Hanover, in 1806 the Confederation of the Rhine was formed, consisting of the leading Central and South German states, but entirely under the control of Napoleon, and a few weeks later Francis II. formally resigned the Imperial Crown, and the Holy Roman Empire came to an end. The same year saw the defeat at Jena of Prussia, which had hitherto stood aloof from the struggle. The supremacy of France was marked by the annexation of all North-western Germany and the creation of the kingdom of Westphalia at the expense of Prussia. But the spirit of German freedom was not dead. A wonderful outburst of national feeling accompanied the reorganisation of Prussia under Stein, and all Germany joined in the colossal struggle which ended with Waterloo and the banishment of Napoleon to St. Helena.

In 1815 the Congress of Vienna made considerable restitutions and redistributions of territory, and a confederation was formed consisting of 39 German states, including four free towns, each independent in internal affairs but sending representatives to a permanent Diet in Frankfort under the presidency of Austria and regulating questions between the states. To satisfy the general and passionate desire for freedom it was provided that constitutional government should be set up in each state. The provision was shamelessly evaded; even in Prussia nothing was done beyond the establishment of provincial diets, and the reality of despotism was hardly tempered by constitutional forms. But the desire for German unity and German freedom grew ever more intense. A practical bond of union was constituted in the Customs Union (*Zollverein*) between Prussia, Bavaria, Württemburg, and other states. Revolutions in France produced reforms in the smaller states in 1830, and in 1848 a popular rising in Berlin resulted in the granting of constitutional government, while Liberal ministers were appointed in Bavaria and elsewhere. A "Provisional Parliament" of delegates from German states met in Frankfort, and was recognised by the Confederate Diet, which shortly afterwards ceased to exist, handing over its authority to the National Assembly, which appointed Archduke John of Austria as the head of a new central government. The great difficulty (apart from complications with Denmark as to Schleswig-Holstein) was the position of Austria, which had meanwhile had to grapple with a national revolt in Hungary. The refusal of the King of Prussia in 1849 to accept the title of "Emperor of the Germans" led to the dispersal of the Assembly. A period of confused intrigue followed. Prussia formed the "German Union" to the exclusion of Austria. Austria, rendered supreme over Hungary by Russian aid, summoned to Frankfort representatives to reconstitute the confederation. This assembly was finally recognised as a Diet by Prussia and the states which had joined her in the German Union. The revolution of 1848 was followed by increased despotism in

Austria and the smaller states, and it was only in 1857 that Liberal policy prevailed in the Prussian government and Chamber. The accession to the Prussian throne of William I. in 1861, and the appointment as Prime Minister of Count Bismarck, threw foreign and domestic policy into the hands of one of the greatest diplomats and statesmen of history. War with Denmark in 1864 was followed by disputes between Prussia and Austria, nominally as to the settlement of Schleswig-Holstein, really as to German supremacy, and in 1866 Austria was completely defeated and finally excluded from Germany. Even Bavaria and the states which had sided with Austria concluded alliances with Prussia, giving her supreme command in future wars, and a Confederation of German states north of the Main was formed under Prussian leadership. A Customs Treaty with the southern states led to the meeting at Berlin in 1868 of a Customs Parliament elected by the whole of Germany. In the great struggle with France the North German Confederation was supported by the southern states, and on January 18, 1871, the King of Prussia was solemnly proclaimed German Emperor at Versailles.

The *German Empire* was then constituted as a federation of 25 sovereign states, to which at the conclusion of the war was added Alsace-Lorraine as a common Imperial province administered by the central authority. Of these states Prussia, with over 37,000,000 of inhabitants, is by far the largest, and the Imperial dignity is hereditary in the Prussian royal family. The representative bodies of the Empire are:—(1) the Bundesrat, or Federal Council, of fifty-eight members, apportioned among the states roughly according to size, and annually appointed by the separate governments; (2) the Reichstag, or Diet, of 397 members, elected by universal suffrage and ballot for five years; executive power is vested in the Emperor, legislative in the Emperor, the Bundesrat, and the Reichstag. The Bundesrat, presided over by the Imperial Chancellor, acts under his direction as a supreme administrative and consultative board, with twelve standing committees, each including representatives from four states. Its consent is necessary for the declaration of offensive war. The Empire has supreme control over the army and navy, Imperial finance and commerce, posts and telegraphs (save in Bavaria and Württemburg), and railways as affecting national defence; and Imperial legislation takes precedence of that of single states in so far as concerned with civil and criminal law of general application, the general rights of German subjects, patents and copyrights, control of the press, and several other matters. With the exception of Alsace-Lorraine, and the Grand Duchies of Mecklenburg-Schwerin and Mecklenburg-Strelitz, all German states are constitutional—the six larger states possessing two chambers, the smaller states one chamber of representatives, and the free cities legislative assemblies.

The establishment of the Empire in 1871 has brought about a real union of the German states, which have been drawn ever closer together since the war. Peace has been observed, but a peace

purchased at the cost of the maintenance of an enormous standing army, which it is even now the object of the Government to increase. The German army, in which great improvements have been made since 1870, is probably the most effective military force which the world has seen, and is the standing symbol and constant instrument of German unity. Education is universal and compulsory, and has been brought to extraordinary perfection. There are twenty-two universities, and large numbers of technical colleges and excellent secondary schools of all sorts. The Empire has been largely organised under the vigorous administration of Prince Bismarck. The main result of his foreign policy has been a cordial alliance with Austria-Hungary. In 1872 an alliance was concluded between the three Emperors of Germany, Austria, and Russia, which was subsequently joined by Italy, and although of late years Russia seems to have, to some extent, withdrawn and to have favoured a French alliance, yet the Triple Alliance has been a constant factor in European politics. In domestic affairs many difficulties have been encountered. With the birth of the new Empire commenced the long struggle of Prince Bismarck with the Papacy. The Jesuits were expelled in 1872, and in 1873 the famous "Falk Laws" imposed secular restrictions on all ecclesiastical appointments. The strict enforcement of these laws led to intense discontent and ill-feeling among Catholics. The contest ended with the grant of many concessions and the confession by Prince Bismarck in 1887 that his policy was practically changed. A strong popular movement against the Jews—the "Judenhetze"—reached a head in 1881, and seems now to be gaining fresh strength. The democratic movement known as Socialism, aiming at the regulation and organisation by the State of labour and production, has grown rapidly. The number of voters supporting Socialist candidates for the Reichstag largely increased until 1907, when the Socialists only secured 29 seats, as against 56 in 1903. The attempts on the Emperor's life in 1878 were attributed to this movement, and a series of repressive measures were passed giving the Government extreme police powers. On the other hand, Prince Bismarck recognised the need of dealing with the causes of discontent, and inaugurated an era of "labour policy" by legislation compelling employers to institute a system of insurance in favour of their work-people, since followed by the adoption of an important state-aided scheme of insurance against death and old age. In 1888 the Emperor William I. died, and the premature death, after a reign of three months, of the beloved Crown Prince, who succeeded him as Frederick III., disappointed the hopes of those who had anticipated a Liberal policy on the part of the Crown. His son and successor, William II., is a sovereign who takes a strong view of his functions as emperor and king. His reign has been characterised by the further development of the labour policy inaugurated by Prince Bismarck. The Emperor has not, however, been generally in accord with the views of the great Chancellor, whose resignation was accepted in 1891.

Of late years the desire of founding a colonial empire has been strongly expressed, and considerable acquisitions have been made in Africa. In 1890 a much coveted addition was made to the German Empire by the cession of the British possession of Heligoland. In 1898 Bismarck died.

Germinal Cells. [STRONGE.]

Germination, the sprouting of a seed or other plant-germ. Thus the term is applied to the first starting in growth, after a period of rest, of the spores (q.v.) of fungi, or even of the grains of pollen (q.v.), the male germ of flowering plants. The requisite conditions for germination are moisture, a certain degree of warmth, and, in most cases, a supply of air or oxygen. In many spores and pollen-grains germination consists in the imbibition of water (or of a dilute solution of sugar) followed by the rupture of an outer spore-coat, or *exospore*, and the protrusion of the inner coat or *endospore* in finger-like or thread-like processes (*hyphe* or *pollen-tubes*). In the more complex seed (q.v.), among flowering plants, the process begins similarly by the imbibition of water, the testa or outer seed-coat softening, and the whole seed swelling. The primary root (*radicle*) (or, in the case of most monocotyledons, the adventitious rootlets) then protrudes through the micropyle (a minute hole in the testa). This may be followed, especially in small exaluminous seeds, by the withdrawal of the cotyledons or seed-leaves which then rise above ground, become green, and at once commence assimilation, the testa being often carried up by them as a mere husk; or, in the case of more fleshy or of albuminous seeds, the cotyledons may remain within the seed, or only their petiolar portion be withdrawn, the first leaves to rise above ground belonging to the plumule or primitive bud of the stem. The cotyledons in albuminous seeds feed in a quasi-parasitical manner upon the albumen, serving merely as channels to transfer its nutriment to the young root and shoot. The first-mentioned method of germination is termed *epigeal*—i.e. above ground; the other, *hypogaeal* or under ground.

Germ Theory of Disease. Ever since the end of the 17th century the notion that putrefaction and some forms of disease were associated with the development (in the decomposing substance or within the living body) of certain low forms of life, has been entertained. The researches conducted by Leeuwenhoek into the minute forms of life, which he discovered and studied in water, the tartar of teeth, saliva, etc., undoubtedly played an important part in directing attention to this subject; and, although Leeuwenhoek himself did not formulate any theory of a *contagium virum* (that is, that contagions which produce disease are living parasites), his observations directed attention to a new field of inquiry, and were quickly taken up by the theorists of succeeding generations. The microscope employed by Leeuwenhoek, though a great improvement on anything that existed before his time, was necessarily very imperfect; and, as improved instruments came into use, more and more exact knowledge was obtainable with respect to

the extremely minute forms of life. In 1836 the discovery of an organism in fermenting yeast was first announced, and the theory was broached that the fermentative process was brought about by the growth and development within the fermenting fluids of this microscopic yeast plant. Evidence quickly accumulated in corroboration of this theory; and Pasteur, by a wonderful series of researches, established on a firm basis the notion that fermentation was a vital process. He studied what are now known as the *lactic*, *acetic*, and *butyric* fermentations, and showed that in each instance special characteristic germs were at work. What had now been shown to hold with respect to fermentation was quickly extended to diseased processes, and Pasteur was able to demonstrate that the disease of silkworms known as *pebrine* was due to a microscopic fungus. In 1849 Pollender observed that the juice expressed from the enlarged spleens of animals dead of splenic fever or anthrax contained multitudes of small rodlets, which were, he maintained, vegetable organisms allied to what were then known as *ribrio bacilli*; and he suggested that these rodlets were the cause of the disease. Davaine developed this discovery, and proved a cause and effect relationship between the bacilli and the disease. Meantime the study of the group of microscopic fungi, called by Naegeli *schizomycetes* or fission fungi, was being earnestly prosecuted, and the relationship between certain diseases and this group of minute organisms became more and more apparent. The notion that the development of germs upon wounded surfaces led to suppuration and the breaking down of tissue, suggested to Lister the advisability of employing germicidal substances in surgical dressings, and the great revolution of treatment which is implied in the term "antiseptic surgery" became established. Pyæmia and septæmia were thus shown to be associated with bacterial growth; and, the gerin theory being now well established, it became the fashion to discover a bacillus or micrococcus in every disease, and many hasty generalisations were made. More definite knowledge is now being gradually obtained, and the discovery in 1882 of the tubercle bacillus by Koch showed that one of the most common and destructive of morbid processes was caused by a germ; and not only this, the methods of study which Koch introduced gave promise of further achievements in this branch of research in the future. Koch further formulated four important requirements, which he maintained must be fulfilled before it could be considered that a cause and effect relationship between a given organism and a particular disease was demonstrated. (1) The germ must be shown to be present in the blood or tissues of the diseased animal; (2) this germ must be isolated from such blood or tissues, and obtained in "pure cultivation"; (3) this same pure cultivation, when inoculated into a healthy animal, must be capable of producing the disease in question; (4) the same germs must be again obtained from the blood or tissues of the diseased animal. It has not hitherto been found possible to fulfil all Koch's requirements in the case of many of the suspected disease-producing organisms, but in the case of

leprosy, relapsing fever, typhoid fever, malaria, diphtheria, erysipelas, and actinomycosis, the evidence is nearly as conclusive as in the completely established instances of anthrax and tubercle; while there is very good ground for supposing that it will be possible in the near future to make out a clear case in several other diseases. It may be remarked, in conclusion, that there is much reason for suspecting that certain low forms of animal life, quite distinct from the vegetable bacteria, are to be regarded equally with the fission fungi as disease-producing agents.

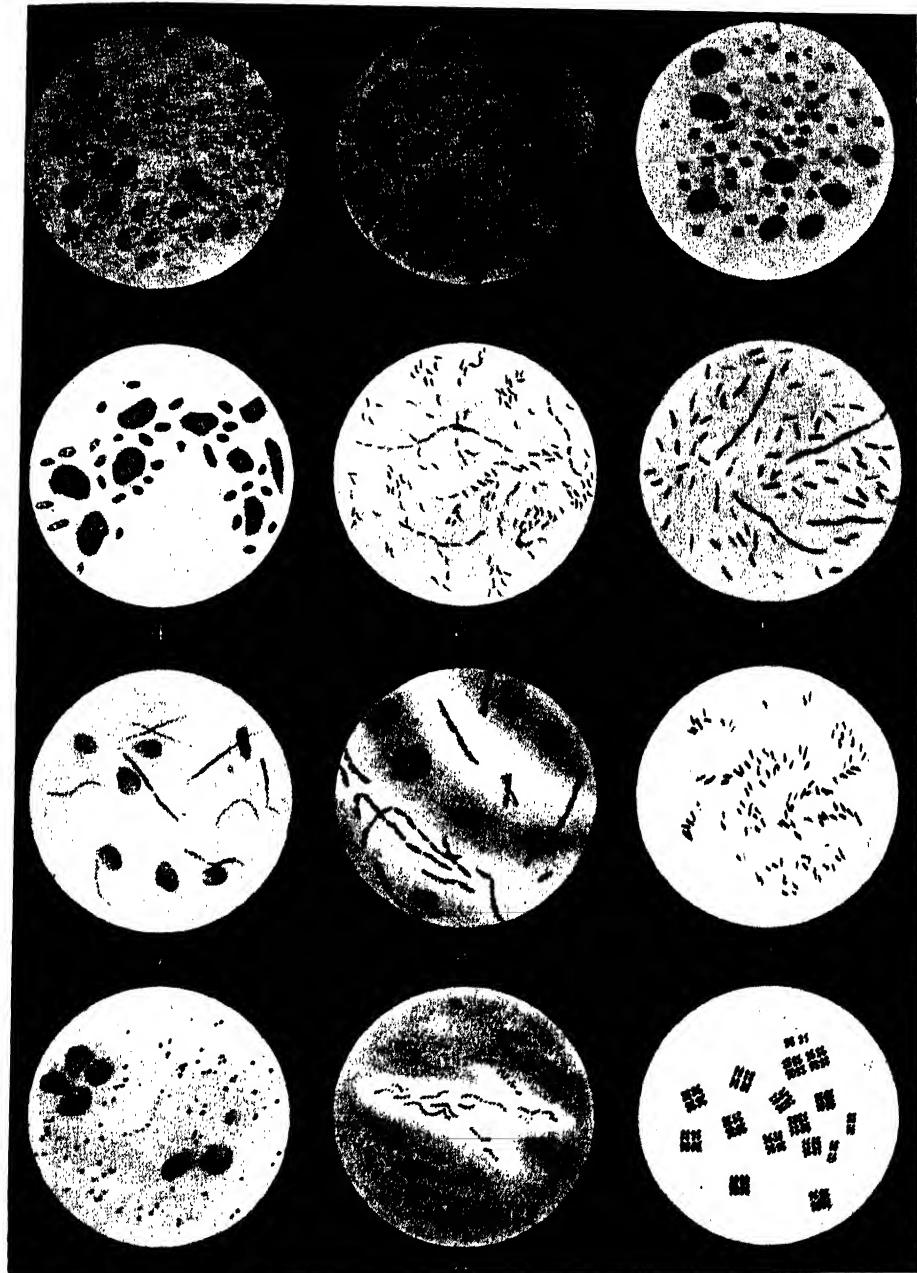
Gérôme, Léon, a French painter, was born in 1824 at Vesoul. In 1841 he entered the studio of Paul Delaroche, in 1847 he exhibited, and soon after travelled for a time in the East. In 1861 he became Professor of Painting at the Ecole des Beaux-Arts. His first notable work was *Age of Augustus* and *Birth of Christ*, and other well-known pictures of his are a *Roman Gladiator in the Amphitheatre*, *Phryne before her Judges*, and *Socrates Looking for Alcibiades at Aspasia's House*.

Gerona, the chief town of the Spanish province of the same name, is at the junction of the Ter and Oña, 54 miles N.E. of Barcelona. The old town has crumbling walls and ruined fortifications, and there is a fine Gothic cathedral with a remarkable nave, 73 feet wide, and a terraced façade, approached by a flight of 86 steps and topped with a rose-window. The town was besieged in 1809, and held out for six months.

Gerry, ELBRIDGE (1744-1814), an American politician, chiefly noted as having given rise to the term "gerrymandering" by rearranging the boundaries of electoral districts in the interests of his own party. It is said that an opponent remarked that one of the new districts was shaped like a salamander. "I call it a gerrymander," said another. Gerry was born in Massachusetts, and graduated at Harvard. In 1773 he was returned to the Massachusetts Assembly, and in 1789 to the first National Congress. In 1797 he was sent to France to negotiate a treaty, and in 1816 became governor of Massachusetts. He was Vice-President of the United States when he died.

Gers, a French department between Lot-et-Garonne on the N. and the Hautes and the Basses Pyrénées on the S., having Landes on the W. It is 75 miles long by 53 miles wide, and contains 2,425 square miles. It is generally hilly, especially in the S., where the Pyrenees send out spurs, some of which are 1,200 feet above sea-level, and enclose pretty valleys opening out at the mouth to a width of 3 or 4 miles. Most of the department lies in the basin of the Garonne, into which run the Save, Gers, Baise, etc., and the W. part is drained by the Adour. The climate is healthy, though changeable, and there is seldom snow or frost. Much of it is covered with wood, meadow, and heath, and a part is given up to vineyards. From the vine is distilled a brandy known as Armagnac. There are many cattle, sheep, mules, and poultry. Auch is the capital.

Gerson, JOHN OF (1363-1439), a noted chief of the University of Paris, and a man of great influence



GERM THEORY OF DISEASE.

BACTERIA.

1. TUBERCLE BACILLUS.	2. BACILLUS OF LEPROSY.	3. MICROCOCCUS TETRAGENUS.
4. DIPLOCOCCUS PNEUMONIAE (FRIEDLANDER).	5. CHOLERA COMMA BACILLUS.	6. TYPHOID BACILLUS.
7. RELAPSING FEVER SPIRILLUM	8. ANTHRAX BACILLUS.	9. GLANDERS BACILLUS.
10. MICROCOCCI IN PUS.	11. STREPTOCOCCUS OF ERYSIPELAS.	12. SARCINA.

(1. 2. 3. 5. 6. 8. 10. 11, magnified 1,000 times; 4, 7, 9, 12, 550 times.)

in the General Councils of Pisa and Constance. He was born at Gerson in the Ardennes, and was sent to Paris to the College of Navarre at the age of 14. At 19 he became a Licentiate of Arts, and then studied theology under a noted professor. In 1384 he became a Bachelor of Theology, and in 1387 he was sent to the Pope at Avignon to plead the cause of one who had been expelled for disputing the doctrine of the Immaculate Conception. In 1392 he became Doctor of Theology, and in 1395 Chancellor of the University of Paris. He directed his efforts towards reformation in the Church, and was earnest in his endeavours to put an end to the Papal schism.

Gervase of Tilbury, so called from his birthplace (13th cent.), was an English priest and author. He went to Rome and other parts of Italy, and, after being ordained, studied law at Bologna. In 1177 he was present at the meeting of the Emperor Frederick and Pope Alexander III. at Venice. He then came to England, and here he wrote *Liber Facetiarum* for Henry, the crowned son of Henry II. After the death of this prince, he visited Sicily, and seems to have had a house at Nola. He then entered the service of the Emperor Otto IV., who made him Minister of the kingdom of Arles. It was at this period that he wrote his principal work *Otia Imperialia*.

Gervinus, GEORG GOTTLIEB (1805-1871), a German political and literary historian, was born at Darmstadt. In 1825 he went to Giessen to study philology, and in 1826 to Heidelberg, where he took Schlosser as his model. Between 1828 and 1830 he brought out an edition of Thucydides, and gave notes upon Blomfield's translation of the same author. In 1832 he went to Italy as travelling-tutor to a young Englishman. In 1833 he wrote some historical treatises, and was made professor-extraordinary, and was appointed professor at Göttingen, after the publication of a work upon the poetical literature of Germany. In 1837 appeared his *Grundzüge der Historik*, and in 1844 he was appointed honorary professor at Heidelberg. In 1847 he aided in founding the *Deutsche Zeitung*. He was a deputy to the National Assembly in 1848, and the hesitation of the then reigning Hohenzollern to adopt the views which were dear to Gervinus implanted in him a hatred of the dynasty which was never overcome, in spite of the events of 1866 and 1870. He retired into private life, and busied himself about his *Shakespeare*, which is highly esteemed in Germany, and has been translated into English. He also wrote a *History of German Literature*, and laid himself open to a charge of high treason and was condemned, but the sentence was quashed upon appeal. He also wrote a comparison between Handel and Shakespeare, which hardly found favour with his fellow-countrymen; but the *History of German Poetry* is generally considered his best work.

Gesenius, FRIEDRICH HEINRICH WILHELM (1786-1842), a German Orientalist and Biblical critic, was born in Hanover, and studied at the University of Helmstadt under Henke. He then

went to Göttingen, where he practised as a *privat-docent*. In 1811 he was appointed professor at Halle, where he taught and spent the rest of his life, save during the war of 1813-14, which closed the University, and two foreign visits which he made in order to carry on his researches into Oriental languages. He did much for Scriptural exegesis and for Semitic philology, and was greatly instrumental in putting Biblical criticism on a more scientific basis.

Gesner, CONRAD VON (1516-1565), a Swiss naturalist, sometimes called the "German Pliny," was born at Zürich, where he was brought up by an uncle, in whose garden he used to gather plants and imbued his first taste for botany. He then went to Strasburg, to Bourges, and to Paris. In 1535 he was at Zürich, was married, and was in poor circumstances. He taught all day for his livelihood, and worked most of the night for love of science. In 1537 he was made Professor of Greek at Lausanne, and in 1541 Professor of Physics and Natural History at Zürich. He wrote upon ancient medicine and botany, and in a treatise upon milk he gave much information about Switzerland. Among many other classical labours, he published in 1545 his *Bibliotheca Universalis*, and from 1551 to 1587 appeared his *Historia Animalium*. He also projected a work upon botany.

Gessner, SALOMON (1730-1788), a Swiss poet and painter, was born at Zürich, where he spent his life as a bookseller. His first work to attract notice was *Lied eines Schweizers an sein Heimathes Mädelchen*. Then followed *Daphnis*, *Idyllen*, and *Der Tod Abels*, which was translated into English, and was often to be met with about the middle of the present century. His writings, like his paintings, belonged to the sentimental school of shepherds and shepherdesses and the like.

Gesta Romanorum, a collection of mediæval tales, which professed to be taken from Roman history, but were in reality fictitious. Probably the original series was really derived from Roman writers, but other tales were afterwards added, some of which can be traced to the *Clericalis Disciplina* of Petrus Alfonsus, a converted Jew of the 12th century, who was indebted to certain Arabian fabulists. According to the best authorities, the collection, as it has been handed down, was formed in England at the end of the 13th or beginning of the 14th century. An English edition issued from the press of Wynkyn de Worde in 1510-15. The tales are entirely devoid of literary merit, but they are interesting as having furnished material to many famous writers, including Gower, Parnell (in the *Hermit*), and Schiller, while others bear a close resemblance to Chaucer's *Man of Law's Tale* and Shakespeare's *Merchant of Venice*.

Getæ are mentioned by Herodotus as one of the Thracian tribes. They dwelt on the north side of the Danube near its mouth, and are said to have crossed the river about the middle of the 4th century B.C. They afterwards united themselves with the Dacians, and proved a formidable adversary to the Romans till 106 A.D., when together

with the Dacians they were subdued by Trajan, and their territory became a part of the empire. They were subsequently overthrown by the Goths (q.v.), with whom they became blended.

Gethsemane, a farm or garden at the foot of Mount Olivet in the valley of Kedron, at a short distance from Jerusalem. It is chiefly noted as the scene of the Saviour's Passion, and some ancient olive-trees are said to mark the sacred spot.

Gettysburg, the chief town of Adams County, Pennsylvania, on the summits of several hills, 50 miles S.W. of Harrisburg. It is memorable as having been the scene of a battle (July 2-3, 1863), sometimes regarded as the most decisive of the War of Secession, between General Meade and the Confederate General Lee, in which the Federals were victorious. Several monuments commemorate the event.

Geyser (Icelandic *geysir* = "gusher"), denoting a fountain of steam and hot water discharged from holes in the ground in various countries, such as Iceland, North America, and New Zealand. The water may be clear and pure, or thick and muddy. The minerals held in solution may be sodium and potassium chlorides, calcium and sodium sulphates, various carbonates and silicates, etc. Such of these substances as separate by evaporation form a crater of solid matter around the orifice. The most wonderful are those near the Yellowstone river. One of these throws up at hourly intervals a column of water 6 feet in diameter to a height of 150 feet. The Icelandic geysers near Mount Hekla have been known since the 12th century. The pink terraces formed by the New Zealand geysers were famous for their beauty, but were destroyed in 1886 by volcanic eruptions. The phenomenon of geysers is associated with that of volcanoes. The eruptions are probably due to the intense heating of water far down in the funnel-shaped hole; the water cannot evaporate on account of the great pressure of the water above it that is at a temperature below boiling-point; but when, at more or less regular intervals, this superincumbent liquid is raised to the boiling-point by bubbles of steam that rise from below, it evaporates and causes the deeper liquid to boil with explosive violence.

Gfrörer, AUGUST FRIEDRICH (1803-1861), a German historian, was born in Württemberg, and educated at the University of Tübingen. He went to Switzerland and to Rome, and afterwards established himself as a theological tutor at Württemberg till 1830, when he was appointed royal librarian at Stuttgart. In 1835 he published a *Life of Gustavus Adolphus of Sweden*, and in 1838 a critical *History of Primitive Christianity*. From 1841-46 he brought out a *Church History down to the Fourteenth Century*. In 1846 he became a professor at Freiburg, and in 1848 was a member of the Frankfort Parliament. In 1853 he joined the Church of Rome. Among other works of his is a *Byzantine History*.

Gharial (Hind. *gharial*), either of the two species of the crocodilian genus *Garialis*, distinguished by their very long jaws, furnished with

very numerous teeth. The common gharial (*G. gangeticus*) from the Ganges is about 20 feet long, and feeds principally on fish and carrion. The second and smaller species (*G. schlegeli*) is from Borneo and Java, and the two are sometimes made a family. The usual but incorrect form garial is due to a misreading of *v* for *r*.

Ghâts, literally *landing-stairs* or *passes*, and in this sense they are used to signify the stairs by which pilgrims descend to the waters of the Ganges and other rivers, and to the steps which lead down to the tanks or artificial lakes so common in India; but generally the name is applied to two mountain ranges which run down the E. and W. coasts of India, and are called the Eastern and Western Ghâts respectively. The Eastern Ghâts are ranges with outlying spurs which pass down the Madras coast, beginning in Orissa and passing S. through Cuttack, then into the Madras Presidency at Ganjam, and still S. through Vizagapatam, Godaveri, Nellore, Chengalpat, S. Arcot, Trichinopoly, and Tinnevelly. As a rule, they are at a distance varying from 50 to 150 miles from the coast, but at their entrance into the Madras Presidency the distance is very little. They are formed geologically of clay slate, hornblende, and limestone, overlying granite, gneiss, and mica slate. In height they average 1,500 feet, but in Ganjam rise to as many as 5,000 feet. The Western Ghâts start to the N. of the Tapti Valley, and go S. through Khandesh, Nasik, Tanna, Satara, Ratnagiri, Kanara, Malabar, the State of Cochin, Travancore, and meet the Eastern Ghâts at Cape Comorin. They are 1,000 miles long, and often nearly touch the shore, and at places they form bluffs and headlands jutting into the sea. On the W. are precipitous cliffs 3,000 feet in height, but on the E. they slope gradually to the plains. Mahabaleswar—a health resort to Bombay—is 4,700 feet high, and other peaks have a height of over 4,000 feet. S. of this place the height declines till Coorg, where it rises to 5,500 and 7,000 feet, at the spot where the Ghâts join the Nilgiri hills, and S. of the Palghât gap they are 7,000 feet high. Their geological formation is trap in the N. and laterite in the S. The Ghâts form watersheds, and in many places are clothed with primeval forest. Near Bombay the railway is carried by a wondrous engineering feat up the Borghât ravine.

Gharzali, ABU MAHOMED AL (1058-1111), a noted Moslem theologian, was born at Khorasan, and became professor of theology in the University of Bagdad. He afterwards went to Mecca, and then lectured at Damascus, Jerusalem, and Alexandria. He then returned to his native town, Tus, where he founded a Sufic College, and spent the remainder of his life in contemplation. He opposed the Arabic school of philosophers, and wrote among other works a commentary on the 99 names of God.

Ghazipur, a district and city in the N.W. Provinces of India. The district contains 2,168 square miles, and consists of a great alluvial plain, which is damp and hot. A railway passes through, and

here and there are lakes formed by old river-beds, the rivers having since changed their courses. The town is on the left bank of the Ganges, 44 miles N.E. of Benares, and extends for 2 miles along the river. Its productions are sugar, longcloth, tobacco, and rose-water, and it is the chief seat of the opium trade. Here is to be seen a ruined palace of the Forty Pillars, and Flaxman's statue of Lord Cornwallis, who died Governor-General of India in 1805.

Ghazni, a city of Afghanistan, was formerly the seat of empire, and played an important part in the early history of British India. It is on the high central table-land in long. $68^{\circ} 20' E.$, and lat. $33^{\circ} 34' N.$, at a height of 17,726 feet above sea-level, and on the road from Kandahar to Kabul, and on the Ghazni river. The climate is cold, and there is a good deal of snow. It was the capital of a native empire from the 10th to 12th century, and then came into the possession of the Sultan of Ghur, and passed afterwards to the Mongols and fell into decay. In 1738 Nadir, Shah of Persia, took it, and at his death it became Afghan. It was stormed by the English in 1839, by the Afghans in 1842, and retaken by the English in the same year. There are many ruins and monuments, among them being the tomb of Mahmud, and the tower of Mahmud.

Ghee, a clarified butter much used in India both as an article of food and for medical purposes. The milk is first boiled and then left to cool, curdled milk being added to cause coagulation. It is then churned for an hour, hot water being mixed with it at the end of the first half hour.

Gheel, a town in the province of Antwerp, 25 miles E. of Antwerp, in the Campine, and on the Herenthals and Moll railway. Its industries are unimportant, but the place is well-known, since for a long time past the neighbourhood has been the lunatic asylum or rather colony of Belgium. Tradition says that an Irish saint, Dymphna, took refuge here, and that at her church miracles of cure were wrought upon lunatics. Owing to the presence of so many pilgrims of unsound mind resorting hither, the inhabitants acquired a kind of hereditary faculty of dealing with such sufferers; and this fitness was officially recognised by Napoleon's prefect, M. Pontecoulant. In 1857 legislation, since supplemented, put matters on a definite footing. Some of the worst cases are, of course, confined and kept under constant medical supervision, but milder cases are distributed among the neighbouring villages, whose inhabitants take the lunatics as boarders, allowing them to share the labours, recreations, and other incidents of family life.

Ghent, or **GAND**, one of the most famous of the old Flemish cities, and the capital of East Flanders, is situated at the confluence of the Lys and Scheldt, 34 miles N.W. of Brussels. The town is built upon 26 islands, and is intersected by canals, which are crossed by 270 bridges. It is surrounded by gardens and meadows, and the old fortifications have been turned into boulevards. The older parts of the city are quaint, but the modern part has

nothing extraordinary. Among the notable buildings are the 13th and 14th century cathedral of St. Bavon, which contains Van Eyck's *Adoration of the Lamb*, the belfry 280 feet high without the top and containing the famed bell Roland, the 15th century hôtel-de-ville, which is a striking example of the period, the palais de justice, the university and the Béguinage where from 600 to 700 nuns live in separate cottage cells forming a small town. The chief industries are cotton, woollen, and linen manufactures, leather, lace, and sugar works, foundries and breweries, and there is a very extensive cultivation of flowers for export. A grand canal connects Ghent with the sea, but the mouth of the canal is in Holland. In 1007 Ghent came into the possession of Baldwin IV., and was made in the next century the capital of Flanders. By the 14th century it had so increased in importance as to provide an army of 80,000 men. The burghers were always noted for their turbulence, and had many a severe struggle with Charles the Bold and other of their rulers. In 1540 Charles V. took away their privileges, and from that time the town decayed. At the French Revolution it was made the capital of the department of the Scheldt, and in 1814 was included in the kingdom of the Netherlands, and became Belgian at the revolution of 1830. Our own John of Gaunt took his name from the town, and the Van Arteveldes were among its most renowned citizens.

Gherkin, the fruit of a small-fruited variety of the cucumber (q.v.), *Cucumis sativus*, which is only grown for pickling.

Ghetto, the quarter of Italian towns in which Jews live, apart from the other citizens. Their isolation was formerly enforced by law. The term is sometimes applied to the Jewish quarter in other towns.

Ghiberti, LORENZO, an Italian sculptor (1378-1455), was born at Florence. He was first trained to his father's calling of goldsmith, but soon took to fresco-painting. When the plague attacked Florence, he went to Rimini, where he painted a fresco for Pandulfo Malatesta. Later the Florentines wished for bronze gates to the Baptistery to match one that had been executed by Andrea Pisano. A competition was instituted, and the successful designs were those of Donatello, Brunelleschi, and Ghiberti. Finally the work was entrusted to Ghiberti, and he set to work. The first gate took him 20 years to execute, and during this period the Council of Florence was held, and brought him new friends and patrons. The second gate, like the first, illustrated subjects from the Old Testament, and the two gates have a wide fame. Ghiberti also made statues of SS. John Baptist, Matthew, and Stephen for the church of St. Michael. He also wrote a commentary upon his art.

Ghika, HELENA, PRINCESS (1829-1888), was born at Bucharest, her father being Prince Michael Ghika. She received a classical education, and then travelled in Germany, France, and Italy, making herself acquainted with modern languages.

She wrote pieces for the theatre, and many other works, one of her chief aims, in which she was successful, being to wake up the Albanian people to a desire for freedom. Her marriage with a Russian prince, with whom she lived for a few years at St. Petersburg, was unhappy, and from 1855 she resided mostly at Florence. She wrote a good deal in reviews and magazines under the name of Dora d'Istria.

Ghilan, a Persian province forming part of the land between Elburz and the Caspian Sea, is bounded on the N. by Russian Caucasia, and contains 4,251 square miles. It is swampy and subject to inundations, but has good forests, and is very fertile, producing barley, wheat, rice, and fruits. The mulberry is largely grown for the silk manufacture. The fisheries are good. The climate is moist, unhealthy, changeable, and stormy.

Ghilyaks, a widespread people of North-east Asia, settled chiefly along the south side of the Sea of Okhotsk, in the island of Sakhalin and the Lower Amour river basin; present two distinct types—one Mongolic, with scanty beard, high cheek-bones, somewhat flat features, and yellowish complexion, the other marked by regular features and bushy beard, attributed by some to Russian mixture, by others to an original kinship with the Ainos of North Japan. [AINOS.] The latter is the more probable view, for they show a marked resemblance to the Ainos in speech, national usages, religion, and traditions, as well as in their physical appearance. There are two main divisions—*Kilé* or *Kileng*, the Kili-ni of the Chinese, and the *Kacheng*, with total population about 8,000, of whom 3,000 are in Sakhalin and 5,000 on the mainland. They live chiefly on the banks of the rivers and along the sea-coast, and are essentially a fishing people, though partly also engaged in hunting and trapping the fur-bearing animals of the surrounding woodlands. Most of the peltries are brought for sale to the Nicolyeff dealers. (J. Barnard Davis, *On the Skull of a Ghiliak*, in *Proceedings of the Anthropological Society*, iii., 1870; Dr. A. Anoutchine, *Memoirs of the Imperial Society of the Natural Sciences*, Moscow, vol. xx., Supplement.)

Ghilzaes (GHILZIS), one of the main divisions of the Afgháns, whose territory extends from the Khyber Pass to Kabul, and thence across the western spurs of the Sufed Koh ("White Mountains") to Ghazni, and down the Tarnak valley to Kandahar and the Pishin district on the Baluchistan frontier. There are two main branches—*Túran* and *Bárán*, with about 120 Khels or septs variously enumerated, and total population 600,000 to 700,000. The Ghilzaes claim Turki descent, and according to the national traditions they entered the Ghor country, West Afghanistan, in the 8th century under Sebakhtakin, a Tatar of the Kilich tribe formerly located on the upper course of the Syr Daría (Jaxartes). From *Kilich* is supposed to be derived the national name *Ghili* through an intermediate form *Kilji*, meaning "swordsmen," "warriors." But no trace now remains of their Tatar origin, all having long been completely assimilated

in type and speech to the Afghán race. (Leech, *The Early Ghilzaes*, in *Journal of the Bengal Asiatic Society*, 1845; H. W. Bellew, *Afghanistán and the Afgháns*, 1879.)

Ghirlandajo, DOMENICO CALLED THE (1449-1494), was born at Florence. Brought up as a jeweller, he took to making portraits of every one he saw. In 1480 he painted St. Jerome and other subjects in a church, and a fresco of the Last Supper. In 1481-85 he worked at frescoes in the Palazzo Vecchio, and was then summoned by Sixtus IV. to Rome to aid in decorating the Sistine Chapel. Here he painted *Christ Calling Peter and Andrew* and other works. He then returned to Florence, and painted frescoes illustrating the life of St. Francis in the church of Sta. Trinita and incidents from the life of the Madonna and St. John Baptist for the church of Sta. Maria Novella. He introduced many historical and other portraits into his work. He is considered especially good in design and perspective, but his colours have suffered. RIDOLFO (1483-1561), son of the above, was also a painter of some note.

Ghomrian. 1. An Algerian tribe of Berber speech, S.W. of Milah, in the province of Constantine. 2. An Algerian tribe of Arabic speech, but originally Berbers, occupy the mountains skirting the right bank of the Shelli near the Duperré district, in the province of Algiers. In their territory are the Roman ruins of Bu-Khirán.

Ghossel, a large Berber confederacy, province of Oran, Algeria, where they occupy both banks of the middle and lower course of the Isser tributary of the Tafna river. The chief allied tribes, all now of Arabic speech, are the Mediuna, Beni-Wazan, Zenita, Shiha, Karabza, and Uled Sidi-Abdelli, with total population 8,000.

Ghosts. [APPARITIONS.]

Ghoul, in Eastern mythology, a demon supposed to disinter and feed on the bodies of the dead.

Ghubri, a Berber tribe of Great Kabylia, province of Algiers, Algeria; occupy the right bank of the Bubehir or Upper Seban river, where Maknen is their chief settlement. Here are the Roman ruins of Ksar-en-Shebel.

Ghur, a mountain district of W. Afghanistan to the S.E. of Herat and N.W. of Kandahar, now in the territory of Herat. Little of it is known. It is inhabited by two races, known as Eimaks and Suris respectively, the former of whom rear many camels for the sake of their wool.

Ghuri, a dynasty that had struggles with Mahmud of Ghazni, and after their own defeat by the Mongols held Herat on sufferance.

Giannone, PIETRO (1676-1747), a Neapolitan historian, who sketched especially the growth of the papal power. He came to Naples when 18 years old, and in 1723 wrote his *Civil History of Naples*, the materials for which had taken him 20 years to collect. He was excommunicated, and went to Vienna, and then to Venice, and was driven from there to Geneva. Being captured by a trick

he was confined for life in the fortress of Turin. Gibbon, in his history, makes free use of Giannone.

Giant, a human being of considerably more than the ordinary stature. The average height of an adult Englishman is 5 ft. 7½ in., but individuals of 6 ft. are not uncommon amongst them; and this is an inch above the average height of the Patagonians, who are admitted to be the tallest living race. Thackeray stood 6 ft. 3 in., and his friend Mr. Higgins—the “Jacob Omnium” of the *Times*—some 4 or 5 in. more. But height that goes far beyond the average may generally be taken as the result of abnormal development which is associated with feebleness of mind and body, and almost invariably followed by premature decay and early death. There is no doubt, however, that a height of between 8 and 9 ft. has been attained, and it has possibly been exceeded. Patrick Cotter (1761–1804), exhibited under the name of O’Brien, is said to have been 8 ft. 7 in., but his memorial tablet in a Roman Catholic chapel in Bristol gives his height as 8 ft. 3 in. The skeleton of Charles Byrne, the “Famous Irish Giant,” in the museum of the College of Surgeons, measures 8 ft. 2 in., so that he probably stood at least 8 ft. 4 in. Winkelmaier, an Austrian, who was exhibited in London, and died in 1887, was probably nearer 9 ft. than 8 ft. The giants of Scripture seem to have been “mighty men” rather than men of extraordinary stature; and the height of Goliath, as given by Josephus, has probably been equalled in our own day. The arguments by which, from the days of St. Augustine to the beginning of the 19th century, it has been sought to prove from Scripture the gigantic stature of early man will carry little weight now. The giants of legend and mythology were beings far exceeding not only the stature, but also the strength and courage and craft, of ordinary mortals. The origin of the former may certainly be traced to the discovery of huge fossil bones at a time when the real nature of these remains was unknown, and giant-myths were invented to account for them; the latter may, with almost equal certainty, be said to be personifications of the powers of nature.

Giant's Causeway, a remarkable mass of doleritic or coarsely-crystalline basalt (q.v.) in county Antrim, on the north-east coast of Ireland. It consists of horizontal flows, so that the columns of the basalt, which are at right-angles to the surface of cooling, stand vertically. They are jointed horizontally, and have thus been eroded by weather and sea into a series of terraces and steps strikingly resembling a piece of Cyclopean masonry. The geological age of the basalts of this region, as indicated by leaf-beds between the lava-flows, seems to extend from the close of the Cretaceous period to the Miocene. Those of Staffa, Mull, and Skye, and some of those of Iceland, are of the same ages.

Gibbet, a kind of gallows, consisting of a wooden post with a projecting arm at the summit, from which criminals were suspended in chains and left hanging as a warning to others.

Gibbon, any species of *Hylobates*, long-armed, tailless Anthropoid apes, from the large islands of the Eastern Archipelago, Sylhet and Assam, Cambodia, the S. of China, and the island of Hainan. The body is very slender, and the fore limbs so exceedingly long that they reach nearly to the ground when the animals are erect, and there are hard patches of bare skin on the buttocks. The gibbons are arboreal in habit, swinging from tree to tree with their long arms, but they walk with difficulty, for the soles of their feet are turned inwards, which, however, enables them to grasp the boughs more firmly. They feed on fruit and leaves, are gentle in disposition, fairly intelligent, and have good memories. *H. syndactylus*, the Siamese, has the first and second toes united as far as the second joint and an air sac opening into the windpipe, whence it is sometimes placed in a separate genus (*Niamanga*). Other species are, the White-handed or Common Gibbon (*H. lar*), the Hoolock (*H. hoolock*), the Silvery Gibbon (*H. leuciscus*), the Agile Gibbon (*H. agilis*), and the Crowned Gibbon (*H. pileatus*). The Hainan Gibbon (*H. hainanus*) was first brought to Europe in 1892, and placed in the gardens of the Zoological Society.

Gibbon, EDWARD, was born at Putney on the 27th April (8th May, new style), 1737. So delicate was his constitution that his life was only preserved by the devotion of an aunt, who made him for years her peculiar care. In 1740 he was sent to school at Kingston-on-Thames, but was removed at the end of the next year on account of the death of his mother. A twelvemonth later he entered Westminster School, for which his aunt had opened a boarding-house. His studies were constantly interrupted by illness. He was hurried from place to place in search of health, and his real education took the form of desultory reading, which early turned in the direction of history. Upon his recovery, at the age of fifteen, his father sent him to Magdalen College, Oxford, where he arrived—to quote his own phrase—“with a stock of erudition, that might have puzzled a doctor, and a degree of ignorance, of which a school-boy would have been ashamed.” He found a total lack of discipline in the university, and almost as great a want of instruction. Left thus to his own resources, the boy turned eagerly to theology. Reading Middleton’s *Free Inquiry*, instead of drawing the inference intended that the claim for a continuance of miracles discredited all miracles alike, he concluded that those of the early Church were genuine; and so, as has been well observed, he reached, at a bound, the position which, nearly a century later, the Tractarians attained by years of study. In the first Christian centuries he found the principles of Catholicism already taught, and felt himself compelled “to embrace the superior merits of celibacy, . . . the rudiments of purgatory in prayers for the dead, and the tremendous mystery of the sacrifice of the body and blood of Christ, which irresistibly swelled into the prodigy of transubstantiation.” When he reached this point, the theologian of fifteen began to study Bossuet, with

the result that on the 8th June, 1753, he was received into the Roman Catholic Church.

This was the turning-point of his life. He was sent to a Calvinist minister at Lausanne, who treated him with such tact that the articles of his Catholic creed "disappeared like a dream." Like a dream, however, disappeared also all higher impulse. Thenceforward Gibbon was known simply as an earthly-minded scholar, warm-hearted, but flippantly sceptical of every religious aspiration. He remained for five years at Lausanne, gaining a breadth of culture, through his knowledge of French, such as he could never have attained in England. Towards the end of the time he fell in love with Mlle. Curchod, the daughter of a pastor, but finding that his father objected to the match, "sighed as a lover" and "obeyed as a son." This was the only ripple of passion which crossed the complacency of his egoism, and it was easily calmed. The lady seems to have retained hopes of the marriage until his next visit to Lausanne in 1763, when his coldness put it out of the question. She married the French minister, Necker, but retained a tender feeling for Gibbon until the end of his life. In a letter, written a month before his death, she spoke of "the sentiment which links my soul for ever to your own."

On his return to England, Gibbon lived partly at his father's estate in Hampshire, where he joined the militia. This force was embodied in 1760, and for two years Captain Gibbon was constantly in camp. In 1761 he published a treatise in French, *Essai sur l'Étude de la Littérature*, and was already meditating the employment of his powers upon some more serious task. Freed from the militia, he went abroad, spent nearly a year at Lausanne, studying the antiquities of Italy, and then visited Rome. It was on the 15th of October, 1764, that, while seated among the ruins of the Capitol and hearing vespers sung by friars in the Temple of Jupiter, he conceived the design of writing the history of the decline and fall of the city, which, however, he did not set about until four years later. Meanwhile he worked with his friend, Deyverdun, at the history of the Swiss struggle for independence, a subject which he finally abandoned. In 1767 and 1768 he helped the same friend to produce a periodical, *Mémoires Littéraires de la Grande Bretagne*, and in 1770 he brought out anonymously *Critical Observations upon the Sixth Book of the Aeneid*, an attack upon Warburton's theory of Vergil's under-world. In 1774 he entered Parliament for Liskeard, and two years later published the first volume of the *History of the Decline and Fall of the Roman Empire*. Its success was immediate and startling, but the chapters upon the causes of the spread of Christianity created an outcry, which led Gibbon to bring out a *Vindication* in 1779. In the same year he was appointed to a sinecure office in the Board of Trade, in reward for his "sincere and silent vote" in favour of Lord North, and also, we may suppose, for a *Mémoire Justificatif* which he had drawn up in reply to a French manifesto. In 1780 he lost his seat, but re-entered Parliament as member for Lymington in 1781, in which year he published the second and

third volumes of his *History*. In 1782 his sinecure was abolished, and before long he determined to take up his abode with Deyverdun at Lausanne, a town which became his home for the remaining ten years of his life. In 1788 his fifty-first birthday (8th May) was marked by the publication of the last three volumes of the *Decline and Fall*. Upon this book Gibbon's fame must chiefly rest. Written with the imperfect views of the 18th century upon the development of civilisation, it has, nevertheless, kept its place without a rival. The project was vast, the ground untrodden, but the encyclopædic knowledge, the keen insight, and brilliant imagination of Gibbon enabled him to give a vivid and enduring picture of men and scenes, and a comprehensive summary of the ages of strife by which the modern world was shaped upon the ruins of the old. As an historian, Gibbon stands almost alone in the skill with which he groups the various parts of his book, and in his capacity for taking broad views of principles and actions while discussing the most minute points with the accuracy of a trained and careful scholar. His style, which in his youth completely fascinated Cardinal Newman, the greatest recent master of varied prose, although artificial and monotonous, is well adapted, in its stately and sonorous march, to the magnitude of the events which it describes.

Such was the great work of Gibbon's life, which, on its publication, was already drawing near its close. In 1793 he was in England, when the rapid development of a long-neglected evil (hydrocele) forced him to seek medical advice. It was, however, too late, and he died on the 15th January, 1794. After his death, his *Mémoires*—a brilliant, though incomplete, autobiography—were published by his friend, Lord Sheffield, together with his correspondence and a number of essays upon historical and classical subjects.

Gibbons, GRINLING (1648–1720), wood-carver and sculptor, was born at Rotterdam, but probably of an English family. He came to London and lived at La Belle Sauvage, where his wondrous carving of a pot of flowers attracted passers-by. He then executed ornaments for the theatre, and for Dorset Garden. He then went to Deptford, and here his copy of Tintoretto's *Crucifixion* attracted the notice of John Evelyn, who introduced him to Sir Christopher Wren, Samuel Pepys, and the king. Though his work did not gain direct approval at Court, the introduction brought him fortune. The king bought his *Stoning of St. Stephen*. The choir stalls of St. Paul's are his work, and there is much of it in other of Wren's churches. He also decorated Windsor, Whitehall, Kensington, Chatsworth, Blenheim, Petworth, and many other houses, and Trinity College Chapel, Oxford, and Belton Hall, near Grantham, have some of his best work. The wooden throne at Canterbury is also his work. His skill was particularly shown in depicting flowers, fruit, game, and still life generally; but he was also very successful in portrait medallions, and carved, too, in marble. From Charles II. to George I. he was the Court master-carver.

Gibbons, ORLANDO (1583–1625), composer, was born at Cambridge. He entered King's College choir in 1596, and worked his way forward till in 1604 he was organist of the Chapel Royal. In 1611 he first came before the world in conjunction with others, but in 1612 he produced madrigals and motets, among them being *The Silver Swan*. He wrote quantities of hymns, anthems, and other sacred music, and in 1625 wrote the music for the reception of Henrietta Maria at Canterbury by Charles I.

Gibbous means literally *hunched* or *hump-backed*, but the term can be used of any swollen or protuberant surface, and is applied in astronomy to the moon, when more than half full, the illuminated portion then having a convex appearance on both sides.

Gibbsite, a rather soft, grey to yellowish mineral usually occurring in stalactitic masses, sometimes in hexagonal crystals of the monoclinic system. It consists of hydrated alumina, and may be represented by the formula $\text{H}_4\text{Al}_2\text{O}_5$. It occurs in a number of localities in the United States, Brazil, the Urals, and Asia Minor. The name is also applied to a mineral of rather uncertain composition, which consists essentially of a hydrated phosphate of aluminium.

Gibel (*Carassius gibelio*), the Prussian carp. [CARP.]

Gibeon, in Palestine, was upon a hill in the plain a few miles N.W. of Jerusalem. The Bible relates the stratagem by which its inhabitants caused Joshua to think they came from a long distance, and so obtained a peace, to which, however, degrading terms were afterwards tacked. Here it was that the sun, as is said, stood still at the command of Joshua.

Gibraltar (Arabic *Jebel al Tarik*, Mountain of Tarik), the Calpe of the ancients, is a mountainous peninsula forming the southernmost point of Andalusia, Spain. To the northward is a low-lying isthmus, to the westward is Gibraltar Bay, and to the southward is the Strait of Gibraltar, which at its narrowest point is about 15 miles broad. The Rock of Gibraltar is grey limestone, rising to a height of 1,440 feet, and is inaccessible on the N. and E. On the N.W., upon the bay, lies the town, a place containing, with the garrison, about 25,000 inhabitants. The whole rock above the town is a network of galleries, and there, as elsewhere, there are formidable batteries, which are supposed to render the position impregnable. The town and fortress were founded about 710 by the Moorish chief, Tarik, and taken by the Spaniards in the 14th century. On August 4th, 1704, they were captured by an English expedition under Admiral Sir George Rooke. The place has since been repeatedly besieged, notably in 1779–82, when it was defended by General G. A. Elliot, but, being succoured with opportune supplies by the navy, has always successfully held out. Gibraltar is a garrison, not a colony, under the Colonial Secretary. It is governed by a general in the army, and usually contains between five and six thousand British

troops. There are two piers, one 1,100 feet and the other 700 feet long, and a good anchorage, but no dry-docks. The chief trade is in wine, spirits, tobacco, sugar, coffee, coal, and provisions, and the port is a free one. The already extensive fortifications have of late been largely added to, and now include rock-cut galleries mounting about 600 guns, the bastioned *enceinte* of the town, armed principally with 18- and 38-ton guns, and some very strong batteries to the S. of the town. The annual revenue of this important strategic possession is about £60,000. [BARBARY APE.]

Gibson, JOHN (1790–1866), sculptor, was born at Giffin, near Conway. At seven years of age he used to draw animals from memory. He was apprenticed at 14 to cabinet-making, and then to wood-carving in Liverpool. His first attempt in marble was a head of Mercury, which led Messrs. Francis to try and get him from his apprenticeship. They finally succeeded, and William Roscoe took him up. In 1816 he exhibited at the Academy, and in 1817 he came to London, and went afterwards to Rome, where he made the acquaintance of Canova and Thorwaldsen, and stayed till 1844, meantime executing many works. He adopted Greek models, and introduced the practice of tinting statuary, a method which he declared to have been employed by the Greeks. His last work was a mantelpiece for Sir John Gladstone.

Gibson, THOMAS MILNER (1806–1884), an English politician, was born at Port of Spain, Trinidad, where his father, a major of the 37th Regiment, was stationed. He came to England, and went to school at Walthamstow, where he had for fellow-scholar Benjamin Disraeli. He graduated at Trinity College, Cambridge, in 1830, and entered Parliament in 1837 as a Conservative, but afterwards became a Liberal, and lost his seat. In 1841 he was returned at Manchester as an advocate of Free Trade, and in 1846 became a member of Lord John Russell's Ministry as Vice-President of the Board of Trade. He lost his seat in 1857, owing to the part he had taken in the Crimean War question, but was returned for Ashton-under-Lyne, which constituency he represented till 1868, after which he retired from political life. From 1859 to 1866 he was again President of the Board of Trade under Lord Palmerston. Mr. Gibson was well-known as a yachtsman.

Giddiness, VERTIGO, a feeling of instability, or of uncertainty as to the position of the body in relation to surrounding objects. Giddiness is sometimes associated with faintness, vomiting, and shortness of breath. It may be due to organic disease of the brain and especially of the cerebellum; to alteration in the quantity or quality of the blood-supply to the brain, as after loss of blood, in anaemia, in heart-disease, and the like; it occurs in megrim, epilepsy, and hysteria, and in association with disease of the stomach; giddiness also occurs as a result of disease of the larynx, "laryngeal vertigo," and as a symptom of certain affections of the ocular muscles. The form of giddiness due to disease of the semicircular canals, "auditory"

vertigo," will be dealt with under the heading **MENIERE'S DISEASE**. A peculiar form of giddiness is sometimes brought on when the patient enters a large open space; to this form the term "Agoraphobia" is applied.

Giddings, JOSHUA REED (1795-1864), an American anti-slavery politician, was born at Athens in Pennsylvania. He went to Ohio, where he was called to the bar in 1820, and returned to the Legislative Assembly in 1826. From 1838 to 1859 he sat in Congress, and in 1842 he underwent a vote of censure for his views on slavery. He resigned his seat, and was re-elected by his constituents. In 1851 he went as consul-general to Canada, where he died. His published works are *Speeches*, *The Exiles of Florida*, and *The Rebellion: its Authors and Causes*.

Gideon, a famous Judge of Israel, who freed his country from the raids of the Midianites and Amalekites. His history is set forth in the Book of Judges (q.v.).

Giessler, JOHANN KARL LUDWIG (1792-1854), a German writer on Church history, was born at Petershagen, near Minden. He went to the University at Halle, and took military service in 1813-15. His first work, published in 1818, attacked and demolished the idea of a primitive gospel. In 1819 he was Professor of Theology at Bonn, and he lectured and wrote there on Church history. In 1821 he published the first volume of his *Church History*. In 1833 he went to Göttingen, and there were published two further volumes of the *History*. The fourth, fifth, and sixth were published after his death. He visited, during his lifetime, England, Edinburgh, and New York.

Giessen, a town in Hesse-Darmstadt, 33 miles N.N.W. of Frankfort, with a population of 13,858, situated at the point where the Lahm joins the Wieseeck. It was formerly fortified, but is now notable for the school of chemistry, which owes its reputation to Liebig (q.v.), and is the chief feature of its university.

Giffen, SIR RONERT (1837-1910), statistician, was born in Lanarkshire, and was in his early years engaged in commerce at Glasgow. Having had some slight journalistic experience in Scotland, he came to London in 1862. He became assistant-editor of the *Economist* and the *Fortnightly Review*, and was for some years city editor of the *Daily News*. In 1876 he became head of the Statistical Department of the Board of Trade, and held that post till 1881. He has published *Essays in Finance* (1879, 1886), and *Stock Exchange Securities* (1878).

Gifford, WILLIAM (1757-1826), first editor of the *Quarterly Review*, was born at Ashburton, Devon, and, having been left an orphan, was at first sent to sea, and then apprenticed to a shoemaker. He found, however, a patron in a surgeon named Cookesley, by whose help he was sent to Oxford. He next acted as tutor to Earl Grosvenor's son. During his subsequent literary career in London he became editor of the *Anti-Jacobin* and the *Quarterly* (1809-24). He wrote the *Bacchid*

and the *Meriad* satires; translated Juvenal; and edited Massinger, Ben Jonson, Ford, and Shirley. He enjoyed two successive Government appointments, and was buried in Westminster Abbey. He was the last representative of the "correctness" in poetry chiefly associated with the name of Pope.

Gift (*donum, donatio*) is the transferring of the property in anything by one person to another voluntarily and without any consideration. The giver is called the donor, and he to whom the gift is made the donee. By the common law an estate might pass as a gift by livery of seisin without deed, but by the Statute of Frauds, 29 Charles II, c. 3, a deed or note in writing is rendered necessary to the transfer of real estate. To complete a gift of goods and chattels delivery of them is necessary, for until then the transaction is not properly a gift but a contract, and the English law will not compel a man to perform his contract unless it is founded upon what is called a good and valuable consideration. Gifts are sometimes declared void as against creditors and purchasers for a valuable consideration. There are some few cases where, in respect of the nature of the interest itself, its transfer is absolutely prohibited—*e.g.* the pay of a military or naval officer, or the salary attached to any public office of trust, is, on a principle of public policy, not assignable. Again, the dealing with a public appointment is contrary to the policy of the law, and is prohibited in most cases by express enactment of the Legislature, and for a like reason the assignment of alimony is illegal. [CONSIDERATION, BANKRUPTCY.]

Gigue, a short piece of music formerly popular as a dance time, and often forming part of a longer composition. In the corrupted form *jig* the word survives as the name of the dance itself.

Gijon, or **XIJON**, a seaport of Spain, in the province of Asturias, 20 miles N.E. of Oviedo. There are some fine buildings in the town, which carries on a brisk export trade in fruit and filberts, and imports colonial produce. A naval school and a public library are also among its institutions.

Gila Monster. [HELODERM.]

Gilbert, SIR HUMPHREY, English navigator, half-brother of Sir Walter Raleigh, was born in 1539 at Greenway, on the Dart, was educated at Eton and Oxford, served with the army in Ireland in 1570, and fought in the Netherlands. In 1578 he was granted a patent to establish settlements abroad, and made his first voyage. In 1583 he went with five ships to take possession of and settle Newfoundland, and on the return voyage in the *Squirrel*, of 10 tons, he was lost. He wrote a very eloquent and learned discourse on the North-West Passage.

Gilbert, SIR JOHN (1817-1897), a celebrated historical painter, was born at Blackheath. He exhibited his first picture (a water-colour) in 1836 at the Suffolk Street Gallery, the subject being *The Arrest of Lord Hastings by the Protector, Richard*,

Duke of York, and from this time onwards continued to send oil-paintings to the British Institution and the Royal Academy. He was knighted in 1871, in which year he was also elected President of the Society of Painters in Water Colours. He became A.R.A. in 1872, and R.A. in 1876. Among his earlier works were *Don Quixote giving Advice to Sancho Panza*, *The Education of Gil Blas*, and *Othello Before the Senate*. He painted many Shakespearean scenes, and contributed to illustrated editions of many English classics. Among his more recent paintings the best are, perhaps, *The Duke of Venice in Council* (1876), *King Henry VI.* (1880), *The Morning of Agincourt* (1884), *Sir Lancelot* (1887), and *Ego et Rex Meus* (1889).

Gilbert, WILLIAM (1540-1603), one of the earliest natural philosophers of England, was born at Colchester. Having graduated and become fellow of St. John's College, Cambridge, he practised medicine in London, and became physician to Elizabeth and James I. In 1600, when he was made president of the College of Physicians, he published his *New Physiologie of the Magnet and Magnetic Bodies, and the Earth as a Great Magnet*. In this book he investigated and illustrated the properties of the magnet, and showed their application to navigation. His collection of books, globes and instruments, bequeathed to the College of Physicians, perished in the Great Fire of 1666. Of him Dryden wrote, "Gilbert shall live till loadstones cease to draw."

Gilbert, SIR WILLIAM SCHWENCK (b. 1836), was born in London, at whose university he graduated. He was called to the Bar in 1864, and was a clerk in the Privy Council Office from 1857 to 1862. Early in his literary career he wrote for *Fun* the *Rab Ballads*, which have subsequently appeared in book form. He has produced numerous comedies and dramas, among which the most notable were the *Palace of Truth* (1870), *Pygmalion and Galatea* (1871), and *Dev'l Drivin* (1877). *The Happy Land* (1873) was a political satire on three members of the then Liberal Ministry. But even the best of these did not mark him off from his contemporaries as did *Sweethearts* (1874), *Engaged* (1877), and still more the librettos which he wrote for Sir A. Sullivan's comic operas *Trial by Jury*, *Princess Ida*, *The Sorcerer* (1877), *H.M.S. Pinafore* (1878), *The Pirates of Penzance* (1880), *Patience* (1881), *Iolanthe* (1882), *The Mikado* (1885), *Ruddigore* (1887). *The Yeoman of the Guard* (1888) and *The Gondoliers* (1890) had more of pathos and less of satire, but were equally successful with the rest. In 1892 Mr. Gilbert furnished the book for Mr. A. Cellier's comic opera *The Mountebanks*, and in 1894 for Dr. Carr's *His Excellency*, while in 1896 he again collaborated with Sir Arthur Sullivan in *The Grand Duke*. In 1904 he produced a play entitled *The Fairy's Dilemma*.

Gilboa, a range of hills in northern Palestine, between the valley of the upper Jordan and the plain of Esdraelon. In this neighbourhood Saul and his sons were defeated by the Philistines and met their death.

Gilchrist, ALEXANDER (1828-61), the biographer of Blake, the poet and artist, was born at Newington Green. He was called to the Bar in 1849, but practised hardly at all, giving his energies to literature instead. After some contributions to periodicals he wrote a *Life of Eliza*, which appeared in 1855. Soon afterwards he went to live in Chelsea, where Carlyle was his next-door neighbour. His *Life of Blake* was unfinished at his death, but was completed by his widow (née Burrows) and published in 1863. Both husband and wife were intimate with the Rossettis. Mrs. Gilchrist, who died in 1885, wrote a *Life of Mary Lamb*, and edited the second edition of *Blake* (1880). Her own *Life and Writings* were published by her son (1887).

Gildas, the supposed author of *De Excidio Britannie*, a history of Britain from the birth of Christ till 560, is thought by some to have been born about 520, by others some years earlier. He was probably a British monk, and is said by an early biographer to have gone to Brittany in his thirtieth year, and there to have founded a monastery and written his book (first printed in 1525). His death is placed at about 570. Aelvin called him "the wisest of the Britons," and Beda made great use of his writings. In the monastery of St. Gildas, near Vannes, in Brittany, Abélard sought refuge. There are translations of Gildas's work by Jos. Stevenson (1838) and Dr. Giles (1841). Their historical value has been impugned by Gibbon and Sir J. Duffus Hardy, but defended by Dr. Guest.

Gilding is the art of adorning a surface by covering it with gold. It was practised by the ancient Egyptians, and is often referred to in the Old Testament. It became common at Rome after the Punic Wars. The various methods now employed fall into three main divisions—mechanical, chemical, and encaustic gilding.

Mechanical Gilding is employed to attach gold-leaf to wood, paper, plaster-of-Paris, etc. A wooden picture-frame first receives a coat of oil-paint, and then several coats of whiting mingled with glue, which are successively smoothed with pumice-stone and sand-paper. The portion to be burnished is then covered with animal size, while gold-size is applied to the remainder. The frame is now ready to receive the gold-leaf, which is laid on with the broad thin brush named *tip*, and afterwards made to adhere more closely by means of a softer and thicker brush. When there is much raised ornament, whiting is not used, as it tends to wear away the outline. Two methods are followed in fixing gilt ornaments to a japanned ground. It is either coated with gold-size before receiving the gold-leaf, or isinglass is used to make the gold-leaf adhere. In the latter case a larger part of the surface is covered, and asphaltum is employed to paint the ornament, as it preserves the gold beneath it when the rest is removed by washing. In the "false gilding" now practised in Germany silver-leaf or tinfoil with a coating of yellow varnish is substituted for gold-leaf.

Chemical Gilding. Electro-gilding is now the

ordinary means of gilding metals [ELECTRO-METALLURGY], but other methods are still employed. *Wash* or *fire gilding* is effected by applying an amalgam of gold to the surface; the mercury is then volatilised, and a film of gold remains fixed to the metal. *Gilding by immersion* consists in applying a solution of gold in nitro-muriatic acid, the acid attacking the metal and setting free a corresponding amount of gold, which adheres to the surface. After both of these processes the object is coloured by covering it with a saline composition, and then applying "gilding wax," a mixture of beeswax and ochre, which is afterwards burnt off.

Enameled Gilding is used for glass, pottery, and porcelain. The gold is precipitated with sulphate of iron or dissolved in *aqua regia*, the acid being removed by the application of heat. The powdered gold is then mixed with one-twelfth of its weight of oxide of bismuth, and a little borax and gum-water. This mixture is applied to the article with a camel-hair brush, and at first has a dingy colour, but the gold lustre is brought up by burnishing with agate and bloodstone.

Gilead ("region of rocks"), a tract of mountainous country east of the Jordan, extending from the Yarmuk on the N. to the borders of Moab and Ammon on the S. The geological formation is of dark-grey limestone towards the summit, and of sandstone lower down. Oak and terebinth forests clothe the slopes of the mountains, and the valleys abound in vegetation. The district was assigned by Joshua to the tribes of Reuben and Gad and the half tribe of Manasseh. Laurence Oliphant wished to colonise it with Jews, and wrote a description of it (*The Land of Gilead*, 1880).

Giles, St., who has given his name to so many churches, is thought to have lived in the 7th century A.D. He was an Athenian of good birth, who gave away all his possessions, and lived first at Arles and afterwards in the desert country in its neighbourhood. Here he is said to have lived in a cave upon the milk of a hind, and to have been traced through her by the King of France, who made him abbot of a monastery. The festival of St. Giles, patron of lepers, beggars, and cripples, is on September 1. He is often known by his Latin name, *Ægidius*.

Gillfillan, George (1813-1878), a Scottish writer and critic, was born at Comrie, Perthshire. In 1835 he became minister of the body afterwards known as the United Presbyterian Church (U.P.'s), and officiated at the Wynd Church, Dundee, for more than 40 years. He displayed ability both as preacher, lecturer, and writer, and just before his death received from his fellow-citizens a public testimony of their esteem. His best-known work is the *Gallery of Literary Portraits*, which appeared at first in the *Dumfries Herald*. *The Bards of the Bible* reached a seventh edition in 1887. Among his other works were lives of Scott and Burns and *Sketches, Literary and Theological*, the two latter of which were posthumous.

Gill, John (1697-1771), a Baptist divine and controversialist, was born at Kettering, Northants.

He taught himself Hebrew and the classical languages, and was a minister in London from 1719 till his death. He defended the authenticity of the *Song of Solomon* against Whiston, and wrote an *Exposition of the Old Testament* (republished with a memoir in 1810), an *Exposition of the New Testament*, and several other didactic and controversial works.

Gillespie, George (1613-48), a celebrated Presbyterian divine, was son of the parish minister of Kirkcaldy. He took an active part in the resistance to Laud's attempt to force the English service-book on the Scots, and in 1643 attended the Westminster Assembly as a representative of the Presbyterians. He wrote an able work, called *Aaron's Rod Blossoming*, in defence of Presbyterianism, and was made Moderator of the General Assembly just before he died.

Gillray, James (1757-1815), a caricaturist of great merit, was born in Chelsea. He was at first a strolling player, then became a successful engraver, and from 1779 till four years before his death devoted his talents to caricature, chiefly of a political character. He at first ridiculed George III. and the Court, but, when induced to desist from attacking them, made Fox and Napoleon his chief subjects. He was his own engraver. He led a very irregular life, and in 1811 became insane. Several collections of his caricatures have been made, notably that by Thomas Wright, which accompanies the *Life and Times of Gillray* (new edition, 1873).

Gills, or **BRANCHIAE**, are the respiratory organs of aquatic animals. Since they occur in many classes, their form and arrangement is very various; essentially, they consist of a portion of the body wall covered by a thin membrane, beneath which there is a network of blood-vessels, the object of this arrangement being to facilitate the aeration of the blood. The surface of the gill is often thrown into complex folds, so that the surface exposed to the water is much increased.

Gilpin, Bernard (1517-83), an English reformer, called "the Apostle of the North," was born at Kentmire, Westmoreland. He was educated at Oxford, where he was converted to Protestantism by the preaching of Peter Martyr. After studying at Louvain, he was appointed Archdeacon of Durham and rector of Easington, and distinguished himself as a zealous reformer. He next became incumbent of Houghton-le-Spring, whence he was hurried to London by order of Bonner on a charge of heresy. He was saved from the stake by an accident which befell him on the journey, and meanwhile Queen Mary died. He was offered by Elizabeth the see of Carlisle and the provostship of his old college (Queen's), but preferred to remain in his parish. He obtained a general licence to preach, and made use of it in all the northern counties with great success.

Gilthead, any species of *Chrysophrys*, a genus of Sea Breams, with about twenty species, from tropical and sub-tropical seas. The body is oblong and compressed, and covered with moderate-sized

scales ; the spines of the long dorsal can be received into a groove. *C. aurata* from the Mediterranean, which was kept by the Romans in their vivaria, occasionally strays to our southern coast. It is about a foot long, silvery-grey above with golden bands on the sides, steel-blue below. There is a brilliant-coloured spot between the eye, whence the generic name (=golden eyebrow). The Gilthead feeds principally on molluscs.

Gil Vicente (flourished 1500), an early dramatist, called the "Portuguese Plautus," the model of Calderon and Lope de Vega, was born at Barcellos, and died at Evora. He produced in all 42 plays, about half of which are written both in Spanish and Portuguese. They were first published complete in 1562, and were reprinted at Hamburg in 1834.

Gimbals are arrangements for supporting magnetic compasses or other instruments in a horizontal position. They consist of two sets of pivots at right-angles to each other, fixed in circular brass hoops surrounding the instrument, which can oscillate in one direction by being pivoted to the inner ring, and in a direction at right-angles to the first by being pivoted with the inner ring to the outer one. If the centre of gravity of the supported instrument be well below the level of the pivots, it will remain with the same horizontal aspect, however irregularly the outer framework may be tilted.

Gin, an alcoholic liquor obtained from grain. The raw alcohol obtained from this source is redistilled, then flavoured with the necessary material, which varies according to the brand, quality, etc., and again redistilled. For the flavouring a large number of substances are employed, as e.g. angelica root, calamus root, sweet fennel, juniper, cinnamon, liquorice, etc. It is usually of strength about 20 "under-proof," and may not be sold below 35 "under-proof" [PROOF SPIRIT.] When pure it should be perfectly clear and colourless. Sweetened gin is produced by the addition of small quantities of pure sugar syrup to the liquor. *Hollands gin* is a Dutch brand very largely imported into Great Britain, which is obtained from barley-malt and usually flavoured with juniper.

Gingelly Oil. [SESAME.]

Ginger, the rhizome of *Zingiber officinale*, a perennial monocotyledon, probably native to tropical Asia, but now cultivated throughout the tropics. It occurs in commerce in two forms—"coated," retaining a brown wrinkled epidermis, and "uncoated," or scraped and dried or bleached. This bleaching is effected by sulphur fumes or chloride of lime, or the ginger is often actually whitewashed with whiting or plaster-of-Paris. The best quality is that from Jamaica. Our total imports vary from 1,600 to 3,500 tons annually. The chief constituents of ginger are starch, a volatile oil to which the odour is due, and a resin which gives it its pungency. The younger shoots (or "green" ginger) are preserved in syrup as a sweetmeat; but the Chinese preserved ginger is mainly the product of the Galangal (q.v.).

Ginger-beer Plant, a remarkable substance acting as the fermenting principle in home-made ginger-beer, occurs in yellowish-white, semi-transparent, gelatinous lumps, and consists of a yeast-plant, *Saccharomyces pyriformis*, the cells of which are symbiotically entangled by a coiled schizomycete, *Bacterium vermiforme*.

Ginger-grass Oil, known in North and Central India as *RUSA OIL*, and in Egypt as *IHRUS OIL*, is also called *OIL OF GERANIUM* (q.v.). It is obtained from the sweet-scented grass *Andropogon Schernanthus*, and is used medicinally in India, as hair-oil by Arabs and Turks, and in Egypt to adulterate attar of roses (q.v.).

Ginkgo biloba, often known as *Salisburia adiantifolia* or the maidenhair tree, is the only species of a genus, belonging to the Yew tribe (*Taxinae*), native to Japan and Northern China. It reaches a large size; has leaves of a unique shape, exactly like maidenhair, only thicker, with a long stalk and a bi-lobed, truncate, broadly cuneate blade; and bears a seed as large as a plum, though not seeding in England, where it is otherwise hardy.

Ginseng, the root of *Panax Ginseng*, a plant belonging to the ivy family, cultivated in Corea and Manchuria, and valued in China as a medicine, being sold at from 6 to 400 dollars an ounce. Its forked form may have suggested its possessing properties conducive to virility as in the case of the mandrake (q.v.); but it has, in fact, no active principle or medicinal action. The roots of another species, *P. quinquafolium*, are imported into China as a substitute from the United States.

Gioberti, VINCENZO (1801-1852), an Italian philosopher and political writer, was born at Turin, and educated for the priesthood. He was made chaplain by Charles Albert on his accession to the throne of Sardinia, but two years later was imprisoned and then banished on account of his liberal opinions. He went to Brussels in 1834, where for eleven years he was teacher of philosophy in a school, and devoted his leisure to his favourite studies. His *Introduction to the Study of Philosophy* (1839-1840) was Platonic in tendency. After publishing some essays, he began to concern himself with less abstract subjects, writing several political works. Of these *The Moral and Civil Privacy of Italy* proposed a confederation of Italian princes, with the Pope as their head and the King of Sardinia as protector. In 1848, when he returned to Italy, he was received with open arms by his countrymen, was elected representative for Turin, and subsequently became President of that Chamber and Prime Minister of Sardinia. He soon, however, resigned office, and went on a mission to Paris, where he settled and published his work on *The Civil Renovation of Italy* (1851). Although he wrote a book against the Jesuits, and some of his works were placed in the *Index Expurgatorius*, Gioberti was by no means a heretic, and his earliest work was a defence of the supernatural.

Giordano, LUCA (d. 1705), an Italian painter of very great facility but little imagination, and one of the most prolific artists that ever lived. His nickname of *Fa Presto* ("Make haste!") is said to have arisen from a frequent exclamation used by his father in the days of his son's popularity. The latter was born at Naples, industriously copied the great masters at Rome and Venice, and assisted Pietro da Cortona, whom he imitated. Madrid, Dresden, and Naples possess the greatest number of his works. He painted in fresco the ceiling of San Lorenzo and the Escorial; and at his native place are to be seen *Christ Driving the Dealers from the Temple* (in S. Filippo Neri) and *St. Francis Xavier Baptising the Indians* (in the museum). *Cupid and Psyche*, a series of twelve pictures, is at Hampton Court.

Giorgione ("Big George"), the name by which Giorgio Barbarelli (d. 1511) is generally known, was a great painter of the Venetian school. He was born near Castelfranco, and studied with Titian under Giovanni Bellini. He settled at Venice, where he soon acquired great fame, and was employed to paint portraits of Gonsalvo di Cordova and two dogs. He executed also many frescoes, the most famous of which are those painted in 1506-7 on the façade of the Fondaco de' Tedeschi, opposite the Grand Canal. Much of his work has perished, and many pictures by other artists, such as Sebastiano del Piombo, Schiavone, and several painters of the Brescian and Friulian schools, have been attributed to him. Giorgione was probably less than 40 at his death. He was buried at his native place, whose church possesses a *Virgin and Child* by him. At the Pitti Palace, Florence, is *A Concert*, and the National Gallery of London has *A Knight in Armour* and *The Birth of Christ*. Giorgione followed Bellini in his landscapes, and excelled in all the chief beauties of the Venetian school. Titian greatly admired him, and was influenced by his style; and to him some critics even attribute *The Concert*. Vasari says that Giorgione was a skilful singer and lute-player; if so, it is a presumption in favour of his having been the creator of this great work. *The Sleeping Venus* of the Dresden Gallery remains unchallenged.

Giotto (1266? 1337), the great Florentine painter and architect, was the son of a peasant named Bondone, living at the village of Colle. At an early age he was a pupil of Cimabue (q.v.), and probably assisted him at Assisi. About the year 1291 he was invited to Rome by Cardinal Stefaneschi, where the *Noricella* in the portico of St. Peter's is probably his work. Returning to Florence some two years later, he painted the chapel of the Podesta or Bargello, and in the *Paradise* series of frescoes inserted portraits of Dante, Corso Donati, and Brunetto Latini. At Padua Giotto decorated the Serovegni Chapel in the Arena Church with 38 frescoes. Dante visited him here, and is thought to have suggested subjects to his friend. The painter now probably wandered from city to city. He is known to have been at Naples in 1333, and the fresco series there called the *Noven Sacramenta of the Church* have been attributed to him. At

Assisi he painted a series of 28 frescoes illustrating the life of St. Francis, and treated the same subject later in the chapel of the Bardi, in Santa Croce, Florence. His work here was until recently covered by whitewash. As master of works of the cathedral and city he designed the famous Campanile, his last work. Giotto married, and had six ugly children, and many anecdotes of him have come down to us from Boccaccio and others. Among others is the story which has given rise to the Italian expression "as round as Giotto's O." When asked by a messenger of the Pope to give a specimen of his skill, the painter is said to have drawn with a pencil dipped in red colour "a circle so perfect and exact that it was a marvel to behold." Giotto is referred to in the *Purgatorio* of Dante (canto xi.). He was the first great Italian painter who studied nature instead of following tradition. He first gave expression to faces, and laid on colour with a light hand. His numerous pupils, the Giotteschi, carried on his work in the same spirit. Ruskin, who contributed the letterpress to the engravings of the Arena frescoes, was never tired of dwelling on the merits of this master.

Gippsland, so called from Sir George Gipps, an early Governor of New South Wales, is the south-eastern division of Victoria, Australia. It has an area of 13,898 square miles. The chief town is Sale. Mining and agriculture employ the inhabitants.

Giraffe (*Giraffa camelopardalis* = *Camelopardalis giraffa*), an African ruminant from the south of the Sahara, sometimes classed with the deer, but more generally placed in a family by itself. Sir Richard Owen considered that its position was between the hollow-horned and the solid-horned ruminants, though partaking more of the nature of the latter group. The adult male is the tallest of living animals, standing from 16 to 18 feet high. This great height is principally due to the very long neck, which, however, has but the usual number of vertebrae (7), though these are excessively elongated. The back slopes considerably from the shoulder to the rump, and gives one the impression that the fore limbs are much longer than the hinder ones. The elevation at the shoulder is really due to the prolongation of the neural processes of the dorsal vertebrae which serve as points of attachment for the muscles of the neck. This will be readily seen on examining a skeleton or a picture of one. The dentition is like that of oxen, and the tongue is prehensile and capable of extension, so that these animals can easily procure the leaves which form their food. Each limb has but two digits, and there are no false toes. The giraffe has two small, solid, persistent horns, covered with skin and hair, and a bony protuberance in the middle line of the face, appearing in old animals as a third horn. The colour is a lightish fawn, with darker spots and blotches, the under surface is white. The species is vanishing, and there is even now great difficulty in procuring specimens.

Giraldus Cambrensis, a Welsh writer whose real name was Gerald de Barri, was born at a castle

in Pembrokeshire about 1146. After studying at Paris he was ordained, and as Archdeacon of St. David's distinguished himself by the activity with which he collected tithes and attacked abuses. In 1176 the see became vacant and the long struggle of his life began. His object was to become bishop and to secure the ecclesiastical independence of Wales. He was twice nominated by the chapter and was elected in 1198, but, though he appealed to the Pope, he was deposed and a Norman bishop appointed. Meanwhile he had become one of Henry II.'s chaplains, and in 1184 accompanied Prince John to Ireland. Two of his books, the *Topographia* and *Expugnatio Hibernica*, give an interesting description of that island at this period. Giraldus read them in public at Oxford. He was offered every Irish see and also those of Bangor and Llandaff, but declined them all. In Wales he was a kind of national hero, but was opposed by the immoral clergy and the Norman barons. He seems to have been a favourite of King John, but the influence of Archbishop Walter was used to prevent his advancement. His preaching of the crusade in Wales had been very effective, and in Paris he drew large audiences to his lectures on canon law. He died somewhere about the year 1216. His *Dc rebus a se gestis* is a fragment of autobiography, and he left several other works, including a *Description of Wales, Itinerarium Cambriae*, and the lives of several mediæval saints and bishops. The whole have appeared in seven vols. in the Rolls Series, edited by Brewer and Dimock.

Girard, STEPHEN (1750-1831), a philanthropic miser, was born near Bordeaux, and after filling every successive rank in the American coasting service, finally settled at Philadelphia. Here he made a fortune and established a bank, which advanced large sums to the Federal Government during the war of 1812-14. He was very mean, if not dishonest, in his private transactions, but was none the less a public benefactor. He nursed those who were sick of yellow fever in 1793, and left a large sum for the building and endowment in Philadelphia of a college for orphan boys. The establishment was to be strictly unsectarian, and was limited to whites. The college has accommodation for over a thousand pupils.

Girardin, ÉMILE DE (1806-81), a French journalist, nicknamed for his political instability "La Girandole" (weathercock), was born in Paris, the natural son of Alexandre de Girardin and Madame Dupuy. His *Émile* (1827) dealt with conditions of birth similar to his own. Next year he became Inspector of Fine Arts, and now began to found several popular journals, the most successful of which was *La Presse*. His principles were summed up in the motto "Aujour le jour." He killed the editor of the *National* in a duel. So far as he had any consistency, he was a republican, and opposed Louis Napoleon's *coup d'état*. From 1862 to 1870 he edited the *Liberté*, and in 1874 founded *La France*. He was for some years a strong Socialist. His dramas were not successful, unlike those of his wife (his first, *née* Delphine

Gay), author of several tragedies in which Rachel acted, and comedies, and of *Lettres Parisiennes*. She had a brilliant salon, but died as early as 1851.

Girardin, FRANÇOIS SAINT-MARC (1801-73), French journalist and writer, was born at Paris. He had a brilliant student's career, and in 1834 was appointed Professor of Literature at the Sorbonne. In 1844 he was elected to the Académie Française, having published works on German education, politics, and literature. His most popular work was the *Cours de Littérature Dramatique*, which attained an 11th edition. His contributions to the *Journal des Débats*, in which he wrote Orleanist articles, also appeared in collective form. He was a member of the Assembly from 1834 to 1848 and again after the fall of the Second Empire.

Girder is an iron or timber beam capable of supporting great loads. The applied load should never be greater than one-third of the breaking load. A girder intended to carry moving loads such as those that traverse a bridge requires to be differently designed from those that only carry stationary loads. Girders should be well supported, and, if of great length, provision should be made for expansion due to temperature. It is usual in such cases to fix one end by pivoting, and to let the other end rest on a small carriage supported on a number of small steel rollers. Cast-iron girders have been employed for some years, and are very convenient in many cases, but for heavier work the advantage of wrought-iron girders has caused their introduction, such being generally built up of two parallel booms one above the other and a somewhat slender web or lattice-work connecting them. The booms themselves are also built up of wrought-iron plates, the number of plates necessary at any one part of the girder depending upon the bending and shearing stresses at that part. Thus in a long plate girder supported at the ends and loaded uniformly, the stresses tending to produce bending are greatest at the middle and the booms are therefore made thickest at that part by superposition of wrought-iron plates riveted together. The stress tending to produce shear at any section diminishes towards the middle. It is usual to design the web or lattice so that it shall stand the shear stress, and for stationary loads on the above girder the lattice must be stronger towards the extremities. It should be noticed that the upper boom is compressed on loading and the lower boom is extended. Wrought iron can stand tension and compression equally well, so that the top and bottom booms are made of the same sectional area. Solid cast-iron girders, on the other hand, have to be made with the bottom flange about five times the area of the top flange, for cast-iron stands five times as much compressive stress as tensile. Increasing the distance apart of the booms increases also the power of the girder to resist bending, so that for the girder to be of uniform strength throughout its length, there is no need to vary the thickness of the booms towards the middle if instead they are there arranged farther apart. The ordinary bow-string girder (q.v.) illustrates this arrangement.

Girders that are fixed at one end and free at the other are called *cantilevers*, and with these it is usual to arrange pairs of cantilevers end to end so that they may balance each other. The Forth Bridge gives the finest example of the use of cantilevers, the spans being built of huge cantilevers 600 feet in length with their free ends pointing towards each other and arranged to carry a steel girder of the ordinary type between them. In the cantilever the bending stresses increase from the free extremity towards the fixed end. The booms are therefore made widest apart at the piers. [BRIDGES, article and plate.]

Girgeh, the capital of a province in Upper Egypt of the same name, is on the left bank of the Nile, 60 miles N.W. of Thebes. Here the Mamelukes fought Mehemet Ali. There are several mosques, and the oldest Roman Catholic monastery in Egypt.

Girgenti, near the site of the ancient Agrigentum, is a town on the S.W. coast of Sicily, 60 miles S.S.E. of Palermo. It has a cathedral, a castle, and a harbour. Rather more than a mile from the city are the ruins of several Greek temples. Corn is stored in caverns and exported from Porto Empedocle.

Gironde, a department in the S.W. of France, on the Biscay coast S. of the estuary of the same name. Its area is 3,760 square miles. Low sand-hills or dunes, flanked by lagoons, lie along the coast. The chief rivers are the Dordogne and Garonne, and Bordeaux is the capital. There is much vine-cultivation and some corn-growing, but there is also a good deal of waste land. Large quantities of salt are obtained from the lagoons. The trade in wine and fruits is facilitated by the Canal du Midi. The manufactures include wax candles, chemicals, sugar, porcelain, and tobacco. The climate is mild and damp.

Girtin, THOMAS (1775-1802), a painter of landscapes in water-colours, was born in Southwark, and early made the acquaintance of J. M. W. Turner. He began to exhibit at the Academy in 1794, his first subjects being architectural. Mr. Ruskin considers that Turner owed much to him. Most of his drawings are in private hands, but there are examples of his art both in Bloomsbury and at South Kensington. His panorama of London was being exhibited at the time of his death, which took place soon after his return from Paris, where he drew and etched some fine sketches.

Girton, a college for the higher education of women, founded at Hitchin in 1869, and removed to Girton, near Cambridge, in 1873. It is under the superintendence of a "Mistress," and seven lady lecturers reside in the college. The other lecturers are for the most part members of the university, and the students enter for the public examinations at Cambridge. "Degree certificates" are given to successful candidates.

Girvanella, a peculiar organism which builds minute twisted calcareous tubes, which have often served as the basis of oolithic grains. It has been

described as a calcareous alga, but is probably one of the Foraminifera (q.v.).

Giulio Romano (d. 1546), the name generally given to GIULIO DEI GIANUZZI (sometimes also called PIPPI), Raphael's best pupil, was born at Rome between 1490 and 1500. He was apprenticed to Raphael in his early youth, and assisted the master in the Vatican. As one of his executors he also received some of his implements and works of art. Though known as "the Roman," Mantua was the scene of much of his best work. Here in the Palazzo del Té he executed his great fresco *The Defeat of the Giants*, and also decorated the cathedral and the ducal palace with similar works. He was about to go to Rome to take up the position of architect of St. Peter's when he died. Giulio was an engineer as well as painter and architect. He drained the marshes round Mantua and protected it from inundations. Of his pictures *The Martyrdom of St. Stephen* is at Genoa; Florence (the Uffizi) has his own portrait and several other works; the Louvre contains *Venus and Vulcan*, *A Nativity*, and other examples; and in the National Gallery is *The Infancy of Jupiter*. At Rome there are several of his Madonnas and the work in the Vatican (*The Battle of Constantine*, *The Apparition of the Cross*, etc.), which he completed for Raphael. Connoisseurs award him much of his master's spirit, but not his grace.

Givaros (JIVAROS, XIVAROS), a powerful Indian nation of Ecuador, where they occupy the forests on the eastern slope of the Andes along the banks of the Paute and other northern headwaters of the Amazons. They are a tall, vigorous people, very fierce and warlike, occupied chiefly with fishing and hunting, and also raising large herds of swine. In battle and on festive occasions they wear attached to a long tress of the hair the heads of the enemy slain by their own hands, prepared with much skill and reduced to about the size of a large apple by extracting all the bones from their integument. The usual arms are iron and wooden spears and darts, besides the blow-pipe, with which poisoned arrows are shot to a great distance with surprising accuracy. The dress is reduced to a simple loincloth, dyed a deep yellow, and the whole body is usually painted a yellowish-red and streaked with long black lines. The Givaro language is extremely harsh, and entirely different from the Kicina, which is the current speech of most of the other Indians in the eastern parts of Ecuador. Hitherto these primitive wild tribes had kept entirely aloof from the whites and other settled populations; but about 1870 some French missionaries penetrated amongst them, and established a central station at Gualaquiza on the Rio Rosario, 95 miles S.E. of Cuenca. (*Annales de la Propagation de la Foi*, September, 1871.)

Gizeh (Ghizeh), a town in Egypt, capital of a province of the same name, stands on the W. bank of the Nile, nearly opposite Cairo. Artificial egg-hatching has been carried on here from time immemorial. Five miles to the W. are the Pyramids (q.v.).



ICEFALL.



CREVASSSE.



GENERAL VIEW OF A GLACIER (ALETSCH GLACIER)



ON THE MORENAE.



GLACIER MOUTH.

GLACIER.

Glacial Period, the earlier portion of the Pleistocene (q.v.) period, during which a gradual refrigeration of climate, of which we have evidence in the mollusca of the Pliocene, became intensified in the northern hemisphere until an ice-cap descended from the pole into the centres of Europe and North America, to Saxony in the one case and to about lat. 39° N. in the other. The underlying rocks, where hard enough to retain them, show not only polished surfaces, but striae, evidently the work of land-ice, mainly in one direction in each district. In the thick accumulation of "till" or unstratified boulder-clay (q.v.), which commonly rests on these polished and striated surfaces, the boulders derived from a distance are found to have come from the direction indicated by the striae. The ice-cap seems to have been from 6,000 to 7,000 feet thick in Norway, filling the Baltic, the German Ocean, and the Irish Sea ; 5,000 feet in the north-west of Scotland ; and nearly 1,500 feet in the Harz. Scandinavian boulders are frequent in the boulder-clay of East Anglia. The southern margin of the sheet seems in Europe to have passed from the neighbourhood of Nijni Novgorod and Kieff across Galicia and Silesia to the Riesen-Gebirge and Erz-Gebirge, the Harz, Hanover, Holland, the Thames, and the Bristol Channel. That of the American sheet is marked by a series of mounds or kames that have been traced from the coast of Massachusetts for over 3,000 miles across the continent.

Beds of peat and stratified sands and clays occurring at various levels in the boulder-clay, and containing the bones of land animals, point apparently to various prolonged episodes of a more genial climate known as *interglacial periods*. Thus, whilst owing to the cold we find the arctic species of birch and willow far south of their present limits, *Pecten islandicus* and other arctic shells in Scotland, the woolly mammoth (q.v.) in Italy, the reindeer in Switzerland, and the musk ox in the Pyrenees, during these warmer periods we find plants of temperate latitudes migrating to Siberia, and the hippopotamus, lion, hyaena, and porcupine travelling northwards into Central Europe.

Whilst during the culmination of the Great Ice Age or period of first glaciation, much of north-west Europe seems to have been at a higher level relatively to the sea than it has ever occupied since, it seems afterwards to have been lowered beneath an ice-laden sea, until shells could be deposited at least 1,350 feet above present sea-level on Moel Tryfaen in North Wales. Then an upward movement to existing levels took place with long pauses, during which the various lines of *raised beaches* (q.v.) were formed, which fringe the coasts of Scotland and Norway. Before the close of the Great Ice Age man seems to have appeared in Europe, for his flint implements occur with the bones of arctic animals in Central France and beneath glacial deposits in various parts of England.

Glacier is a stream of ice that flows down the valleys in high alpine regions by its own weight and by pressure of snow from above. In warmer

climates they must be sought for at high altitudes, about 16,000 feet near the Equator, from 1,000 to 2,000 feet in New Zealand, and from 4,000 to 6,000 feet in Switzerland ; but in higher latitudes, such as Greenland, the ice comes down to sea-level. Icebergs are formed by fracture of the ice sheet as it passes into water. There remains much to be discovered concerning the nature of glaciers. It is generally in motion, the rate of progress varying much with the locality. Valuable experiments were made on the *Mer de glace* near Chamonix by Forbes, Tyndall, and others. It was found that this particular glacier moved at an average rate of 1 foot 10 inches per day. In Greenland 21 feet per day is a fair average. As with rivers of water, the rate of motion at the sides is less than that in the middle on account of retardation by friction. Similarly where the bed is narrowest the glacier is generally deepest. A steep glacier flows more rapidly than one of gentle slope. If the bed is ridged along its length, more or less parallel cracks or *crevasses* appear on the surface. When the ridges are transverse, the crevasses are transverse. If the bed is much broken, both longitudinal and transverse crevasses may occur. It is probable that sharp depressions in the bed produce crevasses on the under surface of the glacier, which is thus rarely continuous throughout its mass. Sudden lowering of the bed produces an *icefall*, the glacier here being broken up into pinnacles and irregular blocks separated by crevasses of great width and often profound depth. Fresh snow may in many cases cover the crevasses, but unless the snow is very thick slight depressions of its surface will indicate the positions of the hidden crevasses. It is probable that the curiously continuous flow of glaciers is due to the process of regelation first pointed out by Forbes ; ice under pressure is liable to become liquefied, and will freeze again when pressure is removed. If, therefore, the stream of ice has to pass over an obstruction, pressure from behind will cause partial liquefaction of those parts that are subjected to the greatest stress ; flow is thereby rendered easier, and after the obstruction is passed the ice becomes solid again. A glacier is fed by snow from high altitudes forcing its way down the hollows first as hard snow or *nev *, but gradually hardening under pressure until it becomes ice, and tributary streams may unite and so form the main glacier. Where it leaves the steeper parts of the mountain its weight will generally cause fracture, and crevasses that are technically termed *berg-schr nds* will mark off the glacier from the *nev * or steamer ice.

Depending upon various conditions of the glacier, crevasses in their passage downwards with the ice become more or less oblique ; they may close up or may become enlarged.

Moraines are heaps or lines of stones and boulders that have fallen upon the glacier and have been carried down by the stream of ice. Medial moraines lie along the centre line of the glacier. Lateral moraines lie along its edges. Terminal moraines are carried forward to the lower end of the glacier, and sometimes pass far down into the valley. When two glaciers meet, it frequently happens that

two of their lateral moraines meet, forming a medial moraine down the main glacier. Moraine heaps may be so great as to hide all traces of glacier, and it is sometimes difficult to tell whether ice exists under the mass of boulders.

Temperature conditions assign a lower limit to the glacier, which may thus change in position. Though the glacier never flows backwards, its lower extremity or snout may seem to do so by being dissolved away more rapidly than the ice stream creeps downwards. Fluctuations in the length and depth of glaciers are observed to take place in periods extending over many years. The plate facing page 98 shows a glacier at a period of shrinkage.

Many watercourses may be carved out in the glacier, vertical plunges or *moulins* occurring where the water falls down perpendicular shafts in the ice, these probably starting initially as crevasses and wearing down under the action of the water. Lake basins may also be occasionally formed in the ice, and present a source of danger in critical situations, where the ice walls enclosing them are not sufficiently strong to withstand the fluid pressure. The catastrophe of 1892 at St. Gervais in the Haute-Savoie is partially explained by this fact.

Gladbach, a town in Rhenish Prussia, 16 miles W. of Düsseldorf. It was formerly the centre of a linen trade, but now chiefly manufactures cotton. Other industries are bleaching, dyeing, paper-making, and brewing. The town is very old, and has a church some parts of which date from the 8th century. Mönchen-Gladbach is to be distinguished from Bergisch-Gladbach, a much smaller place, 8 miles N.E. of Cologne, where drag-nets are made, and there are zinc-works.

Gladiator, one who fought in the amphitheatre at Rome with a sword (*gladius*) for the amusement of the people. The first gladiator show held at Rome was that given by Marcus and Decimus Brutus in 264 B.C. on the occasion of their father's funeral. After they became a form of public entertainment they usually took place in the amphitheatre. Under the emperors they increased greatly in number and magnificence, as many as ten thousand gladiators being exhibited in honour of Trajan's victory over the Dacians. They were finally suppressed by Theodosius (500 A.D.). Gladiators were usually slaves, captives, or condemned criminals, but under the emperors senators, knights, and even women, took part in the combats. Before a show took place, a bill was displayed, giving particulars concerning the contests. The gladiators engaged in a preliminary combat with wooden swords, before the real struggle began. They were called by different names, according to their dress and equipment and the manner in which they fought. When a gladiator was wounded, he was at the mercy of the spectators, who could save his life by turning down their thumbs or cause his instant execution by pointing them upwards. Palms were awarded to the victorious combatants.

Gladiolus, the name of a genus comprising about 90 species, belonging to the Iris family,

natives of South Africa and the Mediterranean regions. They have fleshy corms, sword-like, distichous leaves (whence their name), and spikes of showy, monosymmetric flowers with a funnel-shaped, curved, or arched perianth-tube, and three stamens placed posteriorly. The slender style divides into three petaloid stigmatic segments, much as in *Crocus*. The plants grow three or four feet high, are perennial, can be multiplied by off sets from the corm, and hybridise freely, so that a multitude of sorts are in cultivation.

Gladstone, RIGHT HON. WILLIAM EWART, was born in Liverpool in 1809. He was educated at Eton and Christ Church, Oxford, where he was one of the most brilliant opponents of Reform and Emancipation; and it was as a Tory that he was elected for Newark in the first reformed Parliament (December, 1832). He soon made himself a position in the House, and in two years was made a Junior Lord of the Treasury by Sir Robert Peel. A year later he became Under-Secretary for the Colonies. In the second Peel Ministry he was successively Vice-President and President of the Board of Trade, and the revised and reduced Customs Tariff of 1842 was understood to be mainly his work. But he resigned in 1845 on the question of the proposed Maynooth grant, to which he was opposed. In the previous year he had been entrusted with the carrying of the Railway Bill, which provided for cheap trains and permitted the erection of electric telegraphs. He now retired from Parliament for a year; and thus was brought to a close his first period—that of "firm and unbending Toryism." The second, commencing with his election for Oxford University (1847), was one of transition. So long as his old chief lived, Gladstone did not call himself a Liberal. The measures, however, which he supported were of a truly liberal nature—the Removal of Jewish Disabilities, the Repeal of the Navigation Laws, and, above all, the Abolition of the Corn Laws. As Colonial Secretary he had also to do with the changes that were made in the government of dependencies. In 1851, a year after the death of Peel, he definitely separated himself from his old associates, and became Chancellor of the Exchequer (December, 1852) in the coalition of Whigs and Peelites under Lord Aberdeen. His speech on the affairs of Greece in 1850 had finally established his position as one of the first of living orators; and his attack on Disraeli's Budget two years later proved his great ability as a financier and brought about the fall of the Derby Government. His first Budget speech enhanced his reputation, and in the Palmerston Cabinet, which succeeded the coalition, he continued to hold the Chancellorship. Considering himself, however, bound to oppose inquiry into the conduct of the Crimean War, he retired with the other Peelites in a few weeks. Mr. Gladstone also opposed Palmerston's Chinese policy, and joined the Conservatives in defeating the Conspiracy to Murder Bill. In 1858 he was sent to Corfu as High Commissioner to negotiate for the reunion of the Ionian Islands to Greece. For a third time, during the years 1860–1866, he was Chancellor of the

Exchequer, first under Palmerston and then under Earl Russell. During this period he carried the Post Office Savings Bank Bill, the Repeal of the Paper Duties, and some remissions in taxation rendered possible by the commercial treaty with France. He now also first came into collision with the House of Lords, and emerged triumphant. In consequence of his growing Liberalism he lost his seat for Oxford University, and had to migrate to South Lancashire. In 1865, when Russell became a peer, Mr. Gladstone became, for the first time, leader of the Liberals in the House of Commons. In that capacity he introduced but failed to carry a Reform Bill, while in opposition he effected the abolition of Church Rates, and carried a resolution in favour of the Disestablishment of the Irish Church. On this question the General Election of 1868 was fought; and, though Gladstone lost his seat for South Lancashire, his party won the day, and, being elected for Greenwich, he became Prime Minister. During the six years which followed, the Irish Church Act (1869), the Education Act and the first Irish Land Act (1870), and the Ballot Act (1872), were placed on the Statute-book; and the purchase of commissions in the army was abolished by royal warrant. The settlement of the *Alabama* claims by arbitration made the Ministry somewhat unpopular, and the Irish University question (on which Mr. Gladstone had long changed his views) proved fatal to it. The Liberal Premier resigned, but resumed office until the General Election, when, being defeated, he went into opposition. During the early days of the Conservative Administration he laid down the leadership of his party, but was roused by accounts of Bulgarian atrocities to enter upon a fervid denunciation of Lord Beaconsfield's foreign policy. In the General Election of 1880 he attacked and carried the Conservative constituency of Midlothian, and, having obtained a majority in the constituencies, became First Lord of the Treasury and Chancellor of the Exchequer. He resigned the latter office three years later, and had his first serious illness in the autumn of 1884. In 1881 was passed a Coercion Bill, and, after a struggle with the House of Lords, a second Irish Land Bill; but the Irish were not conciliated, and the Phoenix Park murders were followed by a Prevention of Crimes Act and an Arms Act, giving further powers to the Irish executive. The Arrears Act, another attempt at conciliation, was also passed. The Egyptian question was yet more thorny than the Irish. The rebellion of Arabi was crushed, and Alexandria bombarded; but revolt in the Soudan followed. Hicks Pasha was defeated and killed; and General Gordon, when sent out, was poorly supported, and finally perished at Khartoum before the relieving expedition could reach him. Frequent votes of censure were moved in the Commons, and some of them nearly carried. Meanwhile, a new Franchise Bill was brought forward and carried through the Commons, but was rejected by the Lords, because not coupled with a Redistribution of seats. A violent agitation followed in the autumn (1884), but a compromise was arrived at, and the Redistribution scheme appeared early in 1885. After the passing of these measures, which had temporarily

reunited the Liberal party, dissensions again broke out, and the defeat on the Budget question in May, 1885, was looked upon as a welcome deliverance. The Conservatives (in a minority) held office till after the General Election of 1885, when Mr. Gladstone obtained their defeat on the Allotments question, and for a third time became Premier. He held office for a few months only, as his change of opinion on the Irish question alienated some of his supporters. The Home Rule Bill of 1886 was defeated, and the country ratified the decision of their representatives. Now followed six years of Anti-Home Rule Government, during which Mr. Gladstone, in spite of his years, continued to lead the Opposition. In the General Election of 1892 he was triumphant, and for the fourth time became head of the Government. A Home Rule Bill was introduced, but was thrown out by the House of Lords, and in 1894 he retired from public life. He reappeared, however, on a public platform in 1896, in connection with the Armenian agitation.

He died in 1898, and was accorded a public funeral at the expense of the State. As a zealous Churchman he wrote on the relations of Church and State; attacked Romanism (*The Vatican Decrees*, 1875); *Vaticanism* (1875) as a political force; and did battle with the Agnostics. In 1858 he published *Studies in Homer*, and wrote similar works on the subject in defence of the personality of the poet and the unity of the works attributed to him. *Jurentus Mundi* appeared in 1869. In 1903 Mr. John Morley published his *Life of Gladstone*.

Gladstone's Law, in *Optics*, is the statement of a connection between the refractive index of a transparent medium and its density. It states that the excess of the refractive index above unity of any such substance, whether solid, liquid, or gaseous, is proportional to its density. If μ be the refractive index and ρ its density, then for the one substance

$\frac{\mu - 1}{\rho}$ is a constant quantity. It may be deduced

from physical considerations if the substance be supposed to consist of refracting molecules of constant indexes distributed through the ether, their average distance apart depending upon the density of the substance.

Glagolitic, an old Slavonic alphabet, so called from *glagol*, the name of the letter *G*. The letters are of peculiar form, quite different from those of the ordinary Slavonic alphabet invented by the apostles Cyril and Methodius. They are of uncertain origin, being attributed by some to St. Jerome, by some derived from the cursive Greek script, and by others connected with an old Albanian system of which nothing further is known. None of these hypotheses has met with general acceptance; but it appears certain that Glagolitic is older than Cyrillic. At least the language of the old Glagolitic MSS. is of more archaic form, and all Slav palimpsests show the Cyrillic written over the Glagolitic texts. At present Glagolitic, being of somewhat rigid form, is little used, and mainly restricted to the religious writings of the Dalmatian Slavs. (Dr. M. Gaster, *Ilchester Lectures on Greek*

and Slavonic Literature, London, 1887; Canon Isaac Taylor, in *Archiv für Slavische Philologie*, v. p. 191.)

Glaisher, JAMES, the founder of the Meteorological Society, was born in 1809. In his youth he was employed in the Irish Ordnance Survey, and was three years in the Cambridge Observatory. In 1840 he was made superintendent of the meteorological department of the Greenwich Observatory, and held that position till 1874. In conjunction with Mr. Coxwell, the aeronaut, he made numerous balloon ascents, and once reached a height of nearly seven miles, the greatest yet attained. On this occasion he nearly lost his life. He wrote several scientific works, and completed the Factor Tables of Burckhardt and Dase. He died in 1903.

Glamorganshire, a southern county of Wales, having the Bristol Channel on the S. and S.W., Brecknockshire on the N., Caermarthen on the N.W., and Monmouthshire on the E. Its area is 855 square miles. The northern part of the county is hilly, and is a rich coal-field. The southern is composed of fertile valleys, among them the beautiful Vale of Glamorgan, and has a soil favourable for the growth of corn. The chief rivers are the Taff, the Neath, and the Tawe, and the largest towns Merthyr-Tydfil, Swansea, and Cardiff. Ironstone, anthracite, and limestone are among the minerals obtained from the soil. There is good pasture-land, and much butter and cheese is made. The castles of Oystermouth and Caerphilly date from the Middle Ages, and Roman remains are to be seen. The county of Glamorgan is represented by five members of Parliament. Pop. (19-1), 860,022.

Glance. A number of minerals, chiefly the "sulphides," are designated by the name "glance"—e.g. copper glance, silver glance, cobalt glance, etc. The term is derived directly from the German *glanzen*, to shine or glitter, and is therefore only applied to certain substances which exhibit a high lustre.

Glanders, FARCY, EQUINIA, a disease which especially affects the horse tribe, but occasionally occurs in man and some other animals. It is characterised by the appearance of nodules in the mucous membrane of the respiratory tract (particularly that of the nose), the lymphatic glands are also affected, and the skin is sometimes involved. (Farcy buds, *see* FARCY.) The nodules and tubercles shortly after their first appearance begin to break down, and ulcers are formed which exude a viscid purulent secretion. The onset of the disease is heralded by considerable febrile disturbance, and the animal affected becomes prostrate, and may die within a few days, more usually, however, after the lapse of a fortnight or three weeks. In the horse, and occasionally in man, the course of the malady is much prolonged, and these cases of chronic glanders are sometimes followed by recovery. Glanders has been in recent years shown to be a germ disease; the specific organism is called the *bacillus mallei*. Glanders is one of the diseases of animals that comes within the scope of the Contagious Diseases (Animals) Acts. There is no doubt that much may be done in the way of preventing

the spread of the malady from healthy animals (prompt removal and destruction of glandered horses, disinfection, etc.). The disease was especially prevalent in London in the year 1893, sometimes as many as fifty horses being destroyed by it in the course of one week. The stamping out of the malady is of importance, not only on account of the ravages which it works in the horse tribe, but also to obviate the danger which the prevalence of the equine disease implies to stablemen, coachmen, and others, who are by the nature of their avocations brought into contact with horses.

Glands. 1. A secreting gland in its simplest form consists of a folding in of a mucous membrane, forming a kind of pocket or tubular depression, lined by a series of epithelial cells (secreting cells) which are continuous with the epithelium of the mucous membrane. Each depression is surrounded by a network of capillary blood-vessels, and the secreting cells abstract from the blood the material which they elaborate, and then pass it on into the tubule to be discharged as the secretion of the gland. The glands of the stomach, the glands of Lieberkühn in the intestines, and the sweat glands, may be cited as examples of such simple tubular glands. In the compound tubular glands (salivary glands, pancreas, Brunner's glands of the duodenum, and mammary glands) the structure is more complicated; there are a series of main tubes which divide and subdivide, the whole series of tubes being lined as before with epithelium, but the function of secretion is limited to the ultimate divisions of the system of tubes, the main channels serving merely to conduct the secretion to the surface, and being called ducts. A third group, the aggregate or racemose glands, may be alluded to; in these each main duct branches out into a series of vesicles or acini, constituting what is termed a lobule, the whole gland being thus made up of a system of lobules. The meibomian glands of the eyelids may be given as an example of this type of structure. The term gland is sometimes applied to certain structures in no way allied to the ordinary secreting gland—e.g. the lymphatic glands, thymus gland, pineal gland, etc. (Glands, diseases of, *see* LYMPHATIC GLANDS.)

2. Glands, in *mechanical Engineering*, are collars of metal surrounding cylindrical pieces, such as piston-rods, for the purpose of keeping them in place. They are frequently made to act as covers for stuffing-boxes, in which oil-soaked asbestos-rope, or other lubricative packing, is compressed so as to make an air-tight joint, through which the cylindrical rod may move. [STUFFING-BOXES.]

Glanvill, JOSEPH (1636-80), an able writer who defended the belief in witchcraft, was born at Plymouth and educated at Oxford. He was at first a Nonconformist, but after the Restoration obtained several Church benefices, and was rector of Bath Abbey for 20 years. He was also chaplain to Charles II., and Prebendary of Worcester. A friend of Baxter, Cudworth, and More, he was one of the first fellows of the Royal Society. His fame rests

upon *The Vanity of Dogmatising* (1661), in which was anticipated the invention of the electric telegraph, and Hume's theory of causation; and *Skepsis Scientifica*, a reissue of it, in which he advocated scientific as opposed to scholastic methods of reasoning. In his *Sadducismus Triumphatus* (1671), and in a previous work, he made an ingenious attempt to prove the existence of witches, and maintained that a disbelief in them necessarily involved atheism. He himself thought he had heard spectral drummings and seen supernatural manifestations in the house of a Mr. Mompesson, at Tedworth, Wiltshire.

Glanville, RANULF DE (d. 1190), justiciar of England in the reign of Henry II., and reputed author of the Latin treatise on *The Laws and Customs of England*, is said to have been born near Saxmundham, Suffolk. As sheriff of Lancashire, he was one of the leaders of the army which defeated the Scots at Alnwick (1174), and after holding several other positions of trust he was named justiciar (or chief minister) in 1180. He was of great use to Henry in the war with his sons, and when Richard I. came to the throne he fined him and made him go on crusade. He died before Acre. The legal treatise is sometimes ascribed to his nephew, Archbishop Hubert Walter (q.v.).

Glarus, one of the Swiss cantons, situated between Schwyz and St. Gall, and bounded on the south by Grisons. The river Linth, rising in the Tödiberg, flows north-eastward to the lake of Wallenstadt, which is connected by means of a canal with the lake of Zürich. The canton is mountainous except in the north, the Tädi, 11,765 feet in height, being the highest point. Pasturage is good, and schabziger, a green cheese, is made. In the valleys much fruit is grown. The area of the canton is 267 square miles. Glarus, where Zwingli preached for some years, is the capital. Protestants form a large majority of the population.

Glaserite consists of sulphate of potassium, K_2SO_4 , which occurs naturally in thin prismatic crystals, especially in the neighbourhood of Vesuvius. It is also known by the name of "arcanite."

Glasgow, the largest town in Scotland, and the second in Great Britain, stands on both sides of the river Clyde. The greater part of it is in Lanarkshire; but it also overlaps Renfrewshire in the south-west. It is 45 miles from Edinburgh, and about 406 miles from London, which is reached by rail in 9 hours.

History. The origin of the name is unknown. The Romans had a station on the Clyde, near the site of the town, which became the seat of the bishop in the sixth century. In 1450 Bishop Turnbull obtained a charter; and the same prelate founded Glasgow University. In 1638 the Presbyterians asserted in the city the independence of their kirk. Glasgow also seems to have benefited by the invasion of Scotland by Cromwell. Two great fires consumed part of it in 1652 and 1677. It became the head-quarters of the Covenanters, and

was violent in its opposition to the Act of Union. When, however, the advantages of an increased trade began to be felt the city became very loyal in its sentiments, though in 1819, and again in 1848, there were trade riots. In 1901 a great Exhibition was held.

Trade. Trade-guilds were organised in 1516. Bleaching and calico-printing began here earlier than in Lancashire. The dyeing of Turkey-red had its origin at Glasgow in 1785, and here also bleaching-powder was invented by Charles Tennant in 1798. These, with spinning and weaving, formed until the 19th century the chief industries of the place. Ship-building on a large scale was begun about 1812, when the steamer *Comet* began to ply between Glasgow and Greenock. The tonnage yearly made amounts to about 300,000. Something like £1,000,000 annually is taken in customs' dues. The iron industry has flourished since the patenting of Neilson's hot blasts in 1828.

Buildings. The cathedral, in the early Gothic style, was begun about 1200, and finished in the middle of the 15th century. Its area is 319 feet by 63. The spire, rising from a central tower, is 225 feet high. The crypt under the choir is distinguished by the splendid ornamentation of its pillars and doors. In 1854 the whole building was repaired and restored under Government supervision. There are numerous well-built modern churches, a handsome Royal Exchange, post-office, and city chambers, all of very recent date. Fine statues are to be seen in George Square and elsewhere, including figures of two Glaswegians, Lord Clyde and Sir John Moore. On the north of the Clyde is Glasgow Green; and there are three public parks in different parts of the city.

Institutions, etc. The University buildings, designed by Sir Gilbert Scott, were opened in 1870. There were upwards of 2,000 students in 1908, divided into four "nations." There are 10 professors of subjects included under arts, and 12 of medicine. Besides the usual degrees, that of Master of Surgery (C.M.) is given, and a certificate entitled Literate in Arts (L.A.) is awarded to students who have attended two sessions. The University joins with Aberdeen in sending a Member to Parliament. A Rector is elected every three years by the students. By the help of the Snell exhibitions some of them are enabled to go to Oxford after finishing their course. The Library dates from the 15th century, and receives an annual grant from the Treasury. Dr. W. Hunter in 1781 left a valuable collection of books, coins, etc., to the University. Among Glasgow men have been John Major, Bishop Burnet, Dr. R. Simson, Smollett, Adam Smith, Thomas Campbell, Lockhart, Sir W. Hamilton, and Archbishop Tait.

The Glasgow and West of Scotland Technical College, founded in 1886, has more than 2,000 students. St. Mungo's College and Anderson's College are for medical students, and there are numerous other educational establishments. The chief charitable institutions are the Royal Infirmary, the Western Infirmary, and the Victoria Infirmary.

There are three fine railway-stations: St. Enoch's, the terminus of the Glasgow and South-Western;

the Central Station of the Caledonian ; and the North British Station. There are also underground lines in connection with the North British and Caledonian. Thirty-one miles of tram-lines have been laid down, and transit by water is provided in the river-steamer. The Clyde is crossed by ten bridges, and there is a tunnel under the river, which encircles the centre of the city.

Government of the City. The Provosts or Baillies were at first selected by the Bishops of Glasgow, and when the Church lands were seized by the Crown the right of choosing them was sold to two nobles. In 1636, however, Glasgow became a free royal burgh. From that time till 1833 municipal government was in the hands of the guilds. By the Burgh Reform Act the number of town councillors was fixed at 30, besides the dean of guild and the deacon-convenor. The area of the burgh having widened, there are at present 48 members. Glasgow has 7 representatives in Parliament, besides the members for Govan and Partick.

The lighting of the streets is now in the hands of the Corporation. The water-supply is obtained from Loch Katrine, and flows into a reservoir 7 miles from the city and 70 acres in extent. The City Improvement Trust has spent about two million pounds within the last twenty-five years. Population (estimated in 1909), 872,100.

Glass may be defined as a hard, brittle, translucent, or transparent substance, consisting chemically of a mixture of silicates of various metals. It may be artificial or natural, many igneous rocks—*e.g.* obsidians—being essentially glasses. The name is, however, usually confined to the artificial product. The derivation of the term seems still a matter of doubt, and the Latin *glacies* (ice), the Gallic *glassum* (number), and the Anglo-Saxon *glasian* (to shine), have all been advanced as the source of the present word. The discovery of glass dates back to very ancient times, and was in all probability accidental. The earliest seat of its production was most probably Egypt, where there is reason to believe the process was known about 4,000 years ago. Thus, in some Egyptian tombs at Beni Hassan occur paintings representing glass-blowing, which are referred to a date at least 2,000 years B.C., while some specimens of glass found have been speculatively assigned to dates varying from 1500 B.C. to 2500 B.C. The Chinese also were acquainted with the substance some hundreds of years before the Christian era, but their knowledge was probably derived from the Egyptians. The latter people also understood the art of colouring glass by the admixture of metallic oxides, and the analyses of ancient glasses show that copper, cobalt, and many other oxides used still for the same purpose were the materials they employed. Coloured glass beads and rings (*plain seidyr*) found amid early Druidical remains, have been adduced as evidence that the art was known to the early Britons, but it seems more probable that these were obtained from the traders who visited Britain. This is also supported by their resemblance to other beads, etc., which, as well as

vases, are found around the Mediterranean, and are of Phoenician origin. The latter people it is believed obtained their knowledge of the manufacture directly from the Egyptians. The first mention of glass-making among the Greeks is by Aristophanes, and the industry was not practised to any great extent before the present era. Among the Romans, however, it very speedily spread, and the art was carried to a very high degree of perfection, glass becoming an article of comparatively common usage for domestic as well as decorative and ornamental purposes. Pliny mentioned that they used soda in the manufacture, which is borne out by the analysis of Roman glass, which shows the composition to be not far different from that of our *plate-glass*. They also exported the article, as precisely similar glass is found in Britain and other countries ; the glass drinking vessels known to the Welsh, and mentioned by Llywarch Hen and other 6th century poets, being attributable to this or to their manufacture by the Romans in Britain—the Welsh name *grydr* being derived from the Latin *ritrum*. The Romans were also proficient in the manufacture of coloured glass, and the production of patterns, etc., by melting together differently coloured glasses. For windows, *talo* was chiefly used, but the remains at Herculaneum prove that glass was also employed for this purpose. No record of glass windows is, however, made before the 3rd century. It is stated that they were first used in England in 674, but they did not come into common use until many centuries later. In the 12th century the knowledge of glass-making seems to have been fairly widely spread throughout Europe. It found its chief seat at Venice, the Venetian glass having the highest reputation, and almost completely monopolising the market. To keep the industry from spreading, many laws were passed by the Venetian Council, prohibiting the emigration of glass-makers, and raising the status of such artisans by bestowing upon them many peculiar privileges and honours. From Venice, however, it spread into France, where it became also established. In the 15th century glass-making was practised in England, and although at first it did not find a firm seat, by the 17th century the English manufactures rivalled those of France and Venice. They were also aided by a liberal bounty, which was repealed by Sir Robert Peel. *Flint glass* was invented by the English makers, and *plate glass* was also first made in England. At the present time the chief seats of the English industry are in Lancashire, near Leeds and Bristol, and along the Tyne.

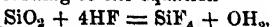
The silicates present in glass vary in the different varieties of glass, but in all cases one of the metals is either potassium or sodium. If only these are present, however, the substance is readily fusible, and is soluble in water, being known as *soluble glass*. It is frequently employed for coating wood and fabrics to render them fireproof. When mixed with others, these alkaline silicates impart fusibility, the soda glass—soft glass—also being always more readily fused than that containing potash—hard glass. *Crown glass* consists of the silicates of potassium and calcium, which are also the constituents

of the *Bohemian glass*, much used for the manufacture of glass vessels for use in the chemical laboratory. If soda replaces the potash a soda-lime glass results which is used for making *plate-glass* and also for ordinary window glass. The common green glass employed for bottles consists of the same ingredients, but with no pains taken to obtain them perfectly pure, so that bottle glass always contains alumina and iron, to the latter the green colour being due. *Flint glass* or *crystal* consists of the silicates of lead and potassium, while a glass known as *strass*, used largely for making imitation gems, contains the same compounds, but with a higher proportion of lead. Lead glass is easily fusible, and possesses a high specific gravity. Owing to its great refractive power [LIGHT] it is largely used in the manufacture of optical instruments—as prisms, lenses, etc. In glass for optical purposes phosphates or borates are also often added, as they appear to improve the quality of the glass. The proportions of the different constituents vary in different forms of glass, but the following table shows the general tendency.

	Window glass.	Plate glass.	Flint glass.
Silica, SiO_2	69	76.0	59
Soda, Na_2O	13	—	—
Lime, CaO	13	6.0	—
Potash, K_2O	—	17.0	8.5
Alumina, Al_2O_3 ...	5	1.0	—
Oxide of lead, PbO ...	—	—	24.5

The specific gravity of glass varies, in the different species, from 2.4 in Bohemian to about 3.6 in flint glass. Its hardness is usually a little higher than that of steel, so that it cannot be scratched by a knife, but can by a file, and easily by a diamond, the plate, etc., readily breaking along the cut, and this is the method adopted for cutting glass to a required shape. When heated it first softens, and when in this condition it can be drawn out, blown, bent, and worked into every conceivable form and shape. At a higher temperature it fuses and liquefies. If melted and quickly cooled it becomes very hard, but also very brittle, and so unstable that it may completely fly to pieces by the merest scratch, though it might be dropped on to stone or struck with a hammer without fracture. [RUPERT DROPS.] If slowly cooled the reverse effect is obtained, and the glass becomes more stable. Glass vessels, etc., therefore, are, after blowing, cooled slowly and regularly, the process being known as *annealing*. If glass be kept heated for a long time and allowed to cool very slowly, it loses its transparency, becomes crystalline or semi-crystalline, and cannot be easily fused. This change is known as "devitrification," and appears to be due to the formation and crystallisation in the glass of a number of definite chemical compounds. The more complex the glass, the greater is its liability to this change, which has to be well guarded against during the manufacture. In water, acids, and the liquids in ordinary use, glass

is practically insoluble, and to this it owes much of its value in the laboratory and the manufactures. It is, however, attacked by strong alkalies e.g. soda, which combine with the free silica, where it is rapidly attacked by hydrofluoric acid, which acts on silica according to the equation



forming a gaseous fluoride of silicon. This acid is hence used for writing, engraving, and etching on glass. In air it remains unaltered, but in time, owing to the action of water and carbonic acid, it may become so corroded as to display beautiful iridescence, an effect imitated in manufactory by the uses of dilute hydrofluoric acid, or hydrochloric acid under pressure. (For the methods of manufacture of glass and some of the processes of ornamentation, see GLASS-MAKING.)

Glassites, a religious sect formed in Scotland about 1728 by John Glass (1695-1773), a Presbyterian minister, who was deposed in consequence of his *Testimony of the King of Martyrs concerning his Kingdom*, in which he asserted that national religious establishments are contrary to the teaching of the New Testament. The adherents of Glass in England and America became known as Sandemanians, from the name of his son-in-law, Robert Sandeman (1718-71), who held that saving faith, though divinely inspired, is identical in its nature with belief in human testimony. Their number is now probably under 2,000. Faraday belonged to this sect.

Glass-making. The processes employed in the manufacture of glass articles almost all depend upon the property it possesses of becoming plastic and ductile at a temperature a little lower than that at which it fuses; and were it not for this the production of the majority of glass articles in common usage would be an impossible matter. The first essentials for the manufacture are the materials. Of these silica is invariably one. Flint, calcined and powdered, was formerly used in flint glass, but now *sand* is the sole source of the silica. When used for this purpose, the sand should be pure and as completely free as possible from iron, which imparts a green colour to the glass. Before use it is washed and then dried in ovens. The potash and soda are employed in the form of salts of these substances. Formerly, the crude ashes obtained by burning seaweed and known as *help* and *barilla* were employed; but as improvements were introduced in the process of manufacture of carbonate of soda (Na_2CO_3) the artificial products replaced the natural. At present, however, sulphate of soda (Na_2SO_4) is generally used instead of the carbonate. The source of the lime is either *chalk* or *limestone*. In the selection of the latter, which yields a harder glass than the chalk, care should be taken to ensure the absence of iron. Lead is usually introduced in the form of *red lead*, Pb_2O_3 , or *litharge*, PbO , the former being the more frequently used. It is obtained for this purpose by heating litharge, prepared from pure lead, in a reverberatory furnace. Broken glass of as nearly as possible the same composition as that being

made is also added to the other ingredients. It is known as *cullet*, and by its use the mass melts at a lower temperature than otherwise. Besides these principal constituents, *cryolite*, *barium carbonate*, and decolorising materials such as *manganese dioxide* are occasionally added. Before melting, the several ingredients are finely powdered, and thoroughly mixed together, this being effected by rotating barrels. The mixture or "frit" is then introduced into the "crucibles" or "pots" for fusion. These crucibles vary in form with the different varieties of glass which it is required to melt in them, but they all require to be made with the utmost care and from the best and most refractory fire-clays, as they have to withstand exceedingly high temperatures (about 2,000° F.), and are exposed continuously to the action of the molten materials inside. In England, Stourbridge clay is usually adopted for their production, which is entirely carried out by hand, the pots being built up of layers, each of which is thoroughly incorporated with the previous by kneading. When built up to the necessary size—about 4 ft. 6 in. high and 4 ft. diameter—they are allowed to set before being removed, the temperature maintained at about 60° F. for many months. They are then baked for from 4 to 6 days in a furnace known as the *pot-arch*, the final heat being equal to that of the glass-melting furnace itself. They are then removed while hot to the furnace where required. The pots generally last from 1 to 4 months. Those used for flint glass are covered, and have an aperture at the side for the insertion of material and removal of the glass; the others are all open. The *furnaces* in which the crucibles are heated require also to be constructed of the most refractory fire-clay and with great care. They are usually circular dome-shaped buildings capable of holding from 5 to 12 crucibles. When heated by coal, the fuel is burned in a grate below the furnace, the flames passing up into the centre and around the pots to flues in the sides. Great care must be taken to keep the fire well and continuously fed and stoked, in order that the temperature of the furnace may not be liable to change. The furnaces are, however, now usually heated by gas, manufactured in separate "*gas producers*" (q.v.), this method being not only more economical and cleanly, but also giving the manufacturer greater control over the temperature. The crucibles are filled in the furnaces by means of long iron shovels through apertures left in the walls for this purpose. The "*charge*" is not added all at once, but from time to time as the materials melt and settle down in the pot. When full of molten glass or "*metal*," the scum is removed from on the top, and the glass is ready for working.

Hollow Ware, such as tumblers, glass jugs, decanters, and countless varieties of other articles, are all blown, and their manufacture necessitates much manipulative skill on the part of the artisan. As a simple case the production of a tumbler may be described. A quantity of the *metal* is collected upon the end or *nose* of a long iron-tube or *blowpipe*, and is rounded by rolling upon an iron slab known as the *marver*. The workman then, by blowing

down the tube, expands the glass into a hollow globe, which is elongated by swinging the blowpipe. The base is then flattened by resting it upon the marver and further blowing. An iron rod known as the *ponty* is attached by a piece of molten glass to the base of the vessel, and then, by touching the hot glass near the blowpipe with a cold iron, it cracks right around its circumference and is detached from the instrument. It is heated again for a short time, and the rim is expanded somewhat to give it the required shape, and is then cut evenly round by an iron shears. By a sharp blow it is detached from the ponty, and placed in the *annealing oven*—a long chamber in which the temperature gradually decreases along its length, the glass vessels, etc., being introduced at the hot end and slowly moved downwards. Bottles, etc., are frequently blown in moulds, as is the case also with many decorative glasses, vases, etc. Frequently also articles are manufactured by direct pressure in moulds of brass or gun-metal. This is employed chiefly for small thick articles, as salt-cellars or jam-dishes. Flint-glass articles are generally after their manufacture subjected to a polishing process known as *cutting*, in which the glass is first ground by revolving wheels supplied with sand or emery and water, and then polished by (1) pumice powder, (2) putty powder or rouge. Glass-tubing for thermometers and scientific purposes is made by blowing out some "*metal*" into a thick globe, when another workman affixes a rod to the end opposite the blowpipe, and the two recede slowly backward until the tube is drawn to the required size. From the tubing afterwards the glass-blower or the optician produces innumerable forms of scientific apparatus. By heating glass rod and drawing it out by a rapidly rotating wheel the glass may be spun to very fine thread.

Crown glass is manufactured by forming a large circular sheet. This is accomplished in the following manner:—The workman, by successive gatherings, collects upon the nose of the blowpipe a quantity of glass, which he then rounds upon the marver into a somewhat conical form. This is expanded by blowing, the apex of the cone, the *bullion point*; being carefully kept exactly opposite the end of the blowpipe. It is thus obtained in the form of a globe, and the front and back of this globe are somewhat flattened. The "*ponty*" tipped with molten glass is then fixed to the "*bullion point*," and the globe detached from the blowpipe by touching with a cold iron. A workman well screened now, holding the ponty, inserts the glass through a large circular aperture into the "*nose furnace*," and rapidly rotates the ponty. Owing to the centrifugal force the mouth of the vessel rapidly expands, and the globe becomes first wine-glass shape, and then spreads into a large circular plate which, still kept rapidly rotating, is removed from the furnace and, after detaching from the ponty, placed in the annealing oven. This method is attended with considerable waste owing to the subsequent cutting into squares and to the presence of the *bull's eye*, where the ponty was affixed. In spite, therefore, of its greater brilliancy, crown is being rapidly replaced by sheet and plate glass.

Sheet glass is manufactured by blowing up a lump of glass, rounded on the marver, into a globe, which is then elongated by swinging and rolled into a cylindrical shape, the end of which is then reheated and blown out. It is next laid on a wooden rest and detached from the blowpipe, and by means of (1) hot glass, (2) cold iron, the end is broken off. The cylinder is next split by running a diamond along its length, internally. It is again heated in the *flattening* furnace and placed on a sheet of glass resting in a large stone bed. It opens out into a wavy sheet which is flattened by means of a block of wood attached to a rod of iron with which the workman rubs it well down into a flat piece. It is then taken to the annealing oven, and thence to the examining-room and warehouse.

Plate glass differs entirely from the preceding in its mode of manufacture, being made not by blowing but by *casting* the glass upon a flat surface. The furnaces employed differ somewhat from those in use for flint and crown glass, as it is necessary to remove the pot itself from the furnace. They are therefore made in the form of long chambers along the sides of which the pots are placed, while doorways large enough for their removal are built along the length. When the glass is in a molten condition the pot is removed by a large fork upon wheels, which fits along a groove in the side of the pot. It is placed upon a truck and immediately run into the casting-room. It is raised by a crane, and, by tilting the pot, the glass is poured over the "casting-table." This consists of a large level metal bed about 30 ft. long and 15 ft. or more broad, constructed of many pieces of iron or phosphor bronze. A cast-iron roller is then rapidly run upon guides back and fore over the length of the table, the thickness of the glass being determined by the height of the guides and its width by their distance apart. The glass plate is then pushed forward into the annealing oven. After annealing the plate is *ground*. This is accomplished by machinery, the plate, lying upon a stone bed, being well rubbed by plates of cast-iron kept supplied with (1) sand, (2) emery and water. After grinding the plate has to be smoothed by a similar machine supplied with fine emery, and smoothed by hand with finest emery-powder—flour emery. The final operation is polishing, usually performed by machine with blocks of wood covered with felt and supplied with water and rouge.

Many devices are employed for ornamentation of glass. It is coloured by the addition of various metallic oxides to the other ingredients; thus, if blue is desired, cobalt or copper (*cupric*) oxide may be employed. Amethyst is given by manganese dioxide, while oxides of iron or chromium yield a green glass, red being obtainable by the use of *cuprous* oxide, or oxide of gold. The latter gives such an intense ruby coloration that it is only employed as a thin casing over colourless glass.

Frosted glass or crackled glass may be prepared by dipping the glass while hot into cold water, and then again heating and blowing to cause the cracked glass to again become. Etching on glass

is performed by coating the glass with wax, then cutting the design through the wax and exposing to the vapours of hydrofluoric acid. Cutting and engraving can also be performed by means of rapidly rotating steel or copper wheels kept covered with sand, or emery and water, or oil.

Painting is effected by means of specially prepared pigments, consisting of a metallic oxide, a flux as borax or sodium carbonate, and fine quartz. They are melted together and so form a coloured glass, which is reground to a fine powder and mixed with a suitable medium—e.g. turpentine—used to paint upon the glass. After painting the glass has to be heated, when the pigment fuses and becomes incorporated with the glass itself. (For history and chemical composition, see GLASS.)

Glass Snake, a limbless snake-lizard of the genus *Pseudopus*, from Asia and the south of Europe. The name is also given to a similar but larger form (*Ophiosaurus ventralis*), from the southern States of the American Union.

Glastonbury, a small town in the centre of Somersetshire, 23 miles S.W. of Bath. Its traditions go back even farther than those of Canterbury to British times. It was the Avalon of King Arthur, and here, according to William of Malmesbury, Joseph of Arimathea founded the first British church. Here, in historical times, Ine, King of the West Saxons, built a church, in which, refounded by Dunstan, were buried the Saxon kings, Edmund, Edgar, and Edmund Ironside. The abbey was destroyed by fire at the end of Henry II.'s reign, and rebuilt during the next century. The last abbot was hanged on the Tor—a hill 500 feet high, which overlooks the town—in the time of Henry VIII. The Abbot's kitchen (14th century) is still to be seen, and also the chapel of St. Joseph (Transition Norman), standing on the site of the ancient building. Glastonbury has in addition two parish churches, a 15th century inn, and other relics of mediæval times. Sheepskins, rugs, and pottery are made in the town. In a village two miles off Fielding was born. Pop. (1901), 4,016.

Glatz, the capital of a district of the same name in Prussian Silesia, 58 miles S.S.W. of Breslau. The town, standing on the left bank of the Neisse, was captured by Frederick the Great in 1742, retaken by the Austrians in 1759, but handed over with the surrounding district to Prussia at the peace. Linen and leather are manufactured here.

Glauber, JOHANN RUDOLF (1638?–68), the discoverer of Glauber's salt, was born at Karlstadt, Franconia. He lived at different times in Vienna, Frankfort, and Cologne, but finally settled at Amsterdam in 1648, in which year he discovered hydrochloric acid. Though an alchemist, cherishing the dream of the philosopher's stone, he rendered many services to chemical science. An English translation of his works was printed in 1689. [GLAUBER'S SALTS.]

Glauber's Salts consists of sulphate of sodium in combination with water, having the formula $\text{Na}_2\text{SO}_4 + 10\text{H}_2\text{O}$. It was first discovered by

Glauber in 1658, and, owing to many remarkable medicinal properties being popularly ascribed to it, was then called *sal mirabile glauberi*. He prepared it by the action of sulphuric acid on salt. If exposed to the air, it effloresces, loses water, and becomes converted into the anhydrous salt which also occurs native as Thenardite, and is largely prepared in the manufacture of hydrochloric acid, and as the first product in production of carbonate of soda, the crude sodium sulphate being known as "salt cake." Glauber's salts form colourless monoclinic prisms. It is soluble in its water of crystallisation at 33° C., and reaches its maximum of solubility at about 34° C., after which the solubility decreases. It easily forms "supersaturated" solutions, which, however, immediately crystallise if a small portion of the salt be added.

Glauchau, a town in Saxony, situated on the right bank of the Mulde, 20 miles W. of Chemnitz. Here large quantities of woollen goods are made for export. Among other industries of the place are dyeing, iron-founding, and carpet-making.

Glaucoma. [EYE, DISEASES OF.]

Glaconite, a greenish mineral of variable composition but essentially a hydrous silicate of aluminium, iron, and potassium, which occurs in grains in various sedimentary rocks, especially in the lower part of the Crataceous system (q.v.), where it gives their names to the Greensands and the Glaconitic (Chloritic) Marl. The grains are sometimes casts of the shells of Foraminifera, and the mineral is now forming similar casts off the coasts of Georgia and Carolina.

Glauclus. (1) Son of Hippolochus, led the Lycians in the Trojan War, and was slain by Ajax. He exchanged arms with Diomedes. (2) A Boeotian fisherman, having eaten of a herb sown by Kronos, became a sea-god. He annually visited the Greek coasts, and delivered oracles to fishermen and sailors.

Glebe ascripti, the name given by Roman jurists to tenants who were bound to the land they cultivated, but remained undisturbed as long as they paid a fixed rent in kind or services.

Glebe Land, the portion of land which appertains to a parish church. If there be both a rector and a vicar, the glebe land in the occupation of either does not pay tithes, though if in the occupation of a tenant it does. The representatives of a deceased incumbent are entitled to the corn sown by him on the glebe. Various statutes have from time to time been passed in order to facilitate the exchange of glebe lands, which are often scattered in small parcels in different parts of the parish. In rectories the chancel and the churchyard also are the freehold of the rector, while in vicarages the churchyard is the vicar's freehold, and the chancel is the freehold of the impropriator. Yet the disposal of the pews and seats in the church appertains by law to the ordinary and practically to the churchwardens, to whom the authority of the ordinary in this respect is delegated. Moreover, no monument can be set up without the ordinary's consent, and an aisle or side chapel in the church,

or a pew in its nave, may be granted by faculty of the ordinary to an individual and his heirs as appurtenant to a particular house in the parish. By a statute passed in the 5th and 6th years of Queen Victoria's reign the Tithe Commutation Commissioner may ascertain and define the boundaries of the glebe lands of any benefice, or, with consent of the ordinary and patron, may exchange the glebe lands for other lands within the same or any adjoining parish or otherwise conveniently situated.

Glee, a form of musical composition confined to England, for three or more solo voices, usually unaccompanied, and in two or three different measures. Unlike the madrigal, it is not strictly contrapuntal, but is written for single voices to each part—a characteristic which distinguishes it from the modern part song. The greatest glee composers were Webbe (1740–1816), Stevens (1757–1837), and John Wall Calcott (1766–1821).

Gleig, GEORGE ROBERT (1796–1888), the biographer of Wellington, was born at Stirling, his father being the Bishop of Brechin. He served as officer in the army in the Peninsula and America, but took orders in 1820. For nearly thirty years he was Chaplain-General and Inspector of Military Schools. *The Subaltern* (a novel) described his experiences of war. Lives of Warren Hastings and Clive had preceded the publication of that of Wellington (1862).

Gleim, JOHANN LUDWIG (1719–1803), a mediocre German poet, but liberal patron of men of letters, was affectionately called "Father Gleim." He wrote seven volumes of verses, imitations of classic lyrists, songs and fables; but his "*Lieder eines Preussischen Grenadiers*" ("Songs of a Prussian Grenadier") was his only work of any merit. He died at Halberstadt, in the neighbourhood of which he had been born.

Glencoe, a valley in Argyleshire, Scotland, extending 10 miles easterly from Ballachulish on Loch Leven. The mountains on both sides of the glen rise almost perpendicularly, and are grotesque in form; and through the vale flows the Coe. The stream is celebrated as the "Cona" of Ossian; and the valley, as the scene of the massacre of the Macdonalds, has been vividly described by Macaulay (*History of England*, ch. xix.). In 1884 a monument was set up to mark the scene of the occurrence.

Glendower, OWEN (OWAIN GLYNDWR), Welsh chieftain, was born about 1359, and died about 1416. He claimed descent from the princes of North Wales, where he had large estates. He studied English law at Westminster, and served in the Scottish campaign of Richard II. Early in the reign of Henry IV. he assumed the title of Prince of Wales, and headed a national rising against the English. Owen soon had to go into hiding, and was excepted from the pardon issued by Henry in 1400; but next year he appeared in South Wales, and also attacked Carnarvon. In 1402 he defeated and captured Sir Edmund Mortimer, who soon after married his daughter and became his ally. By the end of 1403 all Wales had risen against Henry IV., and Glendower had the Percies

as allies. Next year he concluded a treaty as "Prince of Wales" with Charles VI. of France, and summoned a Welsh Parliament. He was, however, soon after defeated by Prince Henry, and one of his sons was taken prisoner. A French force landed at Pembroke in the same summer, but effected little; and Glendower during the next few years suffered many losses, and was generally on the defensive. His last days are obscure. Though Henry V. was willing to pardon him, he refused to treat, and is believed to have died of starvation. Accounts of him are to be read in *Tyler's History of Henry V.*, *Wylie's History of Henry IV.*, and *Pauli's Geschichte von England*. Shakespeare portrays him as a man of great musical talent, but a great braggart (*King Henry IV.*, Part 1).

Glenelg, CHARLES GRANT, BARON (1778-1866), an English statesman, was born in India. Having entered Parliament as a Canningite Tory, he became Chief Secretary for Ireland (1819-22), Vice-President of the Board of Trade (1823-27), and President (1828). He afterwards joined the Whigs, and held the offices of President of the Board of Control (1830-34), and Colonial Secretary (1834-39). He was made a peer in 1835, and retired from political life after his resignation, which followed his approval of the Canadian ordinance of Lord Durham (q.v.).

Glioma, the name given to a form of tumour which occasionally develops in nervous tissue, and particularly in the retina. A glioma consists of delicate cells with a variable amount of interstitial tissue. The growth usually extends rapidly, infiltrating the surrounding tissues. From the situations in which they appear these tumours are apt to give rise to serious symptoms.

Globe Fish, any species of the group Tetrodontina, of the Plectognathous family Gymnodontes, from tropical and sub-tropical seas. The short thick body is scaleless, but more or less covered with spines which become erect when these fish distend themselves with air into the globular form which gives them their popular name. Then they float back downwards, and are driven about by the wind, though we have Darwin's evidence that at least one species can use the pectoral fins for guiding its course. There are several genera, the best known being *Tetronodon* and *Diodon*. In both the jaws form a beak, with strong dental plates for breaking down coral and crushing molluscs, on which they feed. In *Tetronodon* these plates are divided above and below, in *Diodon* they are entire. The flesh is unfit for food, and that of some species is poisonous, but its noxious qualities vary in different individuals and at different seasons.

Globes are spheres of pasteboard, india-rubber, or other material, faced with paper on which may be depicted the arrangements of land and water of the earth, or the configuration of the stars. There are thus *terrestrial* and *celestial* globes, the former of which having the advantage of exhibiting the true relative positions of the objects they mark out as seen from the earth. Terrestrial globes are mounted on pivots at the extremities of

the polar axis, to exhibit the diurnal rotation of the earth.

Globigerinidae, a family of Foraminifera (q.v.) of which *Globigerina* is the type genus. This is of interest as it is one of the leading constituents in the deep-sea deposits known as "Globigerina ooze," and is one of the commonest fossils in the Chalk.

Globulin. The "Globulins" form together a division of those nitrogenous substances known as albuminoids. They are distinguished from other groups of these substances by being (1) insoluble in water, but (2) soluble in dilute acids, alkalies, and solutions of salts. The chief members of the division are *Myosin*, contained in muscle; *Fibrinogen*, in the blood; *Vitellin*, in yellow of egg; and *Harmaglobulin*, in the blood. The latter is frequently called serum globulin, or simply *globulin*. It may be obtained by passing a stream of carbonic acid through the serum of the blood. It is then obtained as a white, granular powder, possessing the properties mentioned above, and coagulates if its solution be warmed to 70° C.

Glogau, or GROSS-GLOGAU, a fortified town in Prussian Silesia, 55 miles N.W. of Breslau. Standing on the left bank of the Oder, on a branch railway from Frankfort to Breslau, it is an important centre of the wool trade. It has stood many sieges from the 11th century onwards, and was captured by Frederick the Great in 1741 from Austria.

Glommen, the chief river of Norway, flows from Lake Oersund in the Dovrefield plateau, in a southerly direction, through Hedenmarken and Christiania into the Skager Ruck, and has a course of about 350 miles. The stream is very rapid, and often overflows its banks. Frequent falls prevent navigation, except for a few miles near the mouth. At Sarpsfos the fall is 75 feet, and is a magnificent sight.

Gloss originally denoted an obsolete or an unusual word in an author's text, or a word in a foreign text requiring explanation, but was afterwards applied to the explanation itself. Collections of glosses on the early Greek poets abounded during the Alexandrian period. The Rabbinical writers expended the same care on the text of the Hebrew Scriptures, and there were numerous glossarians of the Latin Vulgate. Glosses of a different kind, interpreting the matter rather than the words, were inserted by the jurists in the MSS. of Roman and canon law, either on the margin or between the lines. The explanations of Latin, Greek, or Hebrew words by their Teutonic, Keltic, or Romance equivalents or *nice vered* in mediæval MSS., sometimes furnish a valuable clue in etymological researches.

Glossop, a town in Derbyshire, 19 miles W.N.W. of Sheffield. The place, which was incorporated in 1866, is a centre of the cotton trade, and has also iron-foundries, woollen and paper mills, and other industrial establishments. Pop. (1901), 21,526.

Glossophora, the subclass of Mollusca (q.v.) which includes those with a distinct head and a radula (or toothed tongue).

Gloucester. 1. An English town, on the left bank of the Severn, 38 miles N.N.E. of Bristol. It was made a Roman station (*Glevum*) by Claudius, and was the seat of several religious houses, of which the last, a Benedictine Abbey, was suppressed in 1530. Two years later the See of Gloucester was founded. It was united with that of Bristol in 1836, but the two were again separated in 1897. The cathedral was begun in the 11th century, and finished in 1498. It is chiefly Perpendicular, but the crypt and the interior of the nave are Norman. The east window is the largest in England, and the building contains the canopied shrine of Edward II., a statue of Jenner, and a group by Flaxman. Its fan-vaulted cloisters and fine stained glass are also among its glories. The cathedral was restored by Sir Gilbert Scott. Here, alternately with Hereford and Worcester, is held the festival of the Three Choirs. Other notable buildings in Gloucester are the Deanery, the New Inn (15th century), the Tolsey (guildhall), and the King's School. It was in mediæval times one of the chief places in the west of England, and the repulse of Charles I. before it was one of the most important events of the Great Rebellion. It was once the seat of a thriving cloth manufacture, but is now chiefly a commercial town. The trade of its port has largely grown in recent years. Corn and timber are imported, and agricultural and mineral produce form the exports. Several Parliaments have been held at Gloucester, which now has one member. Taylor, the water-poet, Whitefield, and Raikes, were natives of the city. Pop. (1909), 54,000.

2. A port of Massachusetts, U.S.A., 28 miles N.N.E. of Boston, was incorporated in 1642. It has a good harbour and extensive fisheries. Ship-building and granite quarrying also employ the inhabitants.

Gloucestershire, a county in the west of England, bounded on the north by Worcestershire and Warwickshire, on the south by Somerset and Wilts, on the east by Oxfordshire, and on the west by Monmouthshire and Herefordshire. It has an area of 1,258 square miles. The Cotswold Hills in the north and centre of the county are the source of the Thames. Their highest point is over 1,000 feet. Between them and the Severn extend the Vales of Gloucester and Berkeley; and west of the Severn is the Forest of Dean. There is much good pasture, and cheese and cider are largely made. In the Forest of Dean and near Bristol are large coal-fields, and building-stone is quarried. The Wye flows between the county and those of Monmouth and Hereford. The chief towns are Gloucester, Bristol, Cheltenham, and Stroud. Gloucestershire returns five members to Parliament. Pop. (1901), 634,666 (ancient), 331,539 (administrative).

Glover's Tower, a tower built of lead, lined with firebricks, which is employed in sulphuric acid manufacture for the purpose of utilising the nitrous fumes absorbed by sulphuric acid in another stage of the process. The acid is allowed to flow down over flints in the tower, mixed with a weak acid, when the fumes are evolved, and pass off with the sulphurous acid which is passing up the towers to

the chambers to again assist in the production of the acid.

Gloves. The use of gloves as a protection to the hands dates from a very early period. We are told in the *Odyssey* that Laertes wore them when working among the thorns. Xenophon ridicules the Persians because they used them in cold weather, and up to a late period they were regarded as an effeminate luxury by the austere Romans. Passing to the Middle Ages, mention is made in the life of St. Columban, written in the 7th century, of their use in manual labour. In the 12th century they became an article of ecclesiastical apparel, and two centuries later they were much worn by the upper classes in England. The London gild of glovers received a charter in 1464. In Eastern countries the gift of a glove was from a remote period the symbol of a transfer of property, and this is probably the meaning of Ruth iv. 7 and Psalm cviii. 9, "shoe" being a mistranslation. In mediæval times the casting of a glove on the ground was a challenge to single combat. Another symbolic use survives in the white gloves presented to a judge at the assizes when there are no cases for trial. Gloves are now made of many materials, including wool, silk, cotton, and leather. Leather gloves are generally known as "kid," and real kid skins are used for the finer kinds, but the greater number are made of lambskin. Sheep-skin is the ordinary material for dogskin, buckskin, and doe-skin gloves, and calfskin is used for some of the thicker varieties. In some cases the skins are prepared by the ordinary method of tanning or shamoying, but those for "dress gloves" are subject to a special process called "tawing." This consists in applying a mixture of flour, yolk of eggs, and alum to the skins after they have been piled under the influence of heat, an operation which renders them very soft and flexible. When prepared, the skin is cut into separate pieces. These are folded, and an oblong slice is made in the fold at the point where the thumb-piece is to be attached. The fingers are produced by making three incisions in the doubled skin, and sewing them together with gussets on each side of the second and third fingers, and the inner side of the first and fourth. Diamond-shaped pieces are also added at the lower extremity of each finger. Sewing-machines are to some extent used, but most of the sewing is done by hand. The regularity of the stitches is sometimes secured by enclosing the pieces which have to be sewn together in a sort of vice with a serrated edge. The chief seat of the English glove industry is Worcester, where dog-skin gloves are manufactured from the tanned skins of Cape sheep. The English glove-makers are, however, far surpassed by the French, who manufacture large quantities at Paris and Grenoble. Many cheap and serviceable gloves are made at Copenhagen and Brussels. The manufacture of woven and knitted gloves is a perfectly distinct industry, mainly carried on in Saxony and at Berlin.

Glow Discharge, in *Electricity*, means the dissipation of a charge of electricity of high

potential by convection. Particles of air are charged by contact, and are then repelled. Faint sparking is produced at each small transfer and a glow is visible around the surface of discharge. The convection is more vigorous where the surface has greatest curvature, and there the glow is more intense. [BRUSH DISCHARGE.]

Glowworms, a family of beetles known as the *Lampyridæ*. Their popular name is derived from the fact that the female, a wingless, grub-like insect which lives on grass, emits a bright green light from a spot on the abdomen. They are common and widely distributed all through England and Central Europe, and their luminous spot makes them very conspicuous. The male of the common English species is less generally known; it is a light-brown insect about half an inch in length, and is only very slightly luminous. The use of the light to the insect has been much discussed, but it is probably a secondary sexual character, serving to guide the male to the female; it may also serve in part as a protection against birds. The origin of the light in the glowworms, fireflies, click beetles, etc., is discussed under PHOSPHORESCENCE (q.v.).

Gloxinia, a genus of *Gesneraceæ*, a gamopetalous order, natives of tropical America, many of which are cultivated for the sake of their showy flowers. They have apposite, stalked leaves, which are often velvety and rather fleshy, and may be used to propagate the plant, as in *Begonia*. The flowers are either drooping or erect, the corolla bell-shaped and the modern hybrid forms almost polysymmetrically so. They vary much in colour.

Glucinum. [BERYLLOUM.]

Gluck, CHRISTOPH WILLIBALD, RITTER VON (1714–1787), the great German musical composer, was born at Weidenwang, in the Upper Palatinate, probably in 1714. He was brought up in the castle of Prince Lobkowitz at Eisenberg, in whose service his father was forester and his mother a cook. He was educated at a school in Bohemia and at Prague University, and while a student gave lessons in music. He was introduced by Lobkowitz to Prince Melzi at Vienna, and that amateur sent him to study under Sammartini at Milan. His early works, of which the opera *Artaserse* (1741) was the first, were popular, but had all the faults of the Italian school. His fame, however, was such that he was invited to London in 1745, where he produced three operas, and gave a performance with musical glasses. Handel had a poor opinion of his operas, and after a period of study Gluck began to change his conception of operatic music. The chief works of his second or transition period were *Telemaco* (1750) and *La Clemenza di Tito* (1751), produced at Rome and Naples respectively. From 1755 onwards for several years he lived at Vienna, where seven years later his masterpiece, *Orfeo ed Euridice*, was given, the libretto being by Calzabigi. He was obliged, however, to compose a good deal for his noble patrons and to suit their taste. Nevertheless, in 1767 and 1769 he was able to produce his second and third great works, *Alceste* and

Paride ed Elena. The artistic revolution was carried out in Paris, where in 1774 the *Iphigenia in Aulis* was produced. The old school did not, however, submit, and a contest of several years was necessary to ensure the acceptance of the new theories. Gluck was backed by the influence of the Dauphiness, afterwards Queen Marie Antoinette, who had been his pupil at Vienna; but the literary band who supported Piccini, his Italian rival, included D'Alembert, Marmontel, and La Harpe. Each of the rivals composed an opera on the subject of *Iphigenia in Tauris*, but the success of Gluck's work was so great that Piccini delayed the publication of his own opera for two years. In 1780 Gluck returned to Vienna, having amassed a fairly large fortune. He died of apoplexy seven years later, at the age of seventy-three. He composed but little of importance that was not operatic, but in that department he was the first great master, the forerunner of Mozart, Weber, and Wagner. There are three German lives, and one in French, of this great composer, whom Burney called the Michel Angelo of music.

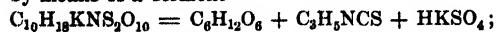
Gluconic Acid is a monobasic acid of formula $C_6H_{12}O_7$, which is obtained by the oxidation of various carbohydrates as starch, grape sugar, maltose, etc. It forms a syrup, and cannot be obtained crystalline; many of its salts, however, such as those of calcium and barium, crystallise well. The ordinary form of the acid is dextrorotatory [POLARISATION], but a levorotatory as well as an inactive modification is also known.

Glucose. [DEXTROSE.]

Glucoses are a class of the carbohydrates of which ordinary grape sugar or dextrose may be regarded as typical. They resemble one another very closely in their properties and reactions, and have the formula $C_6H_{12}O_6$. Their constitution appears to be always that of an aldehyde or a ketone, containing the groups $CH\cdot CHO$, or $CO\cdot CH_2\cdot OH$. The number of glucoses has been considerably extended within recent years, many varieties having been synthetically prepared. The term is also frequently extended to other carbohydrates, which in constitution resemble these glucoses, but contain fewer or greater carbon atoms in the molecule as the pentoses $C_5H_{10}O_5$, the heptoses $C_7H_{14}O_7$, the octoses $C_8H_{16}O_8$, the nonoses $C_9H_{18}O_9$; those glucoses with six carbon atoms being designated hexoses.

Glucosides are a class of bodies which are obtained from plants in all cases, and have not at present been prepared synthetically. They may all undergo decomposition into two or more substances, one of which is always a sugar, usually glucose (hence name). The change may be induced by boiling with water alone under pressure, or, and more easily, by heating with dilute acid or by fermentation. They are usually obtained from the vegetable product in which they occur, by digesting with alcohol. Very many are known, but those of most interest from their products, etc., are *Esculetin* (q.v.), $C_{15}H_{24}O_9$, which yields glucose ($C_6H_{12}O_6$) and *esculetin*; *Amygdalin* ($C_{20}H_{27}NO_{11}$), which yields

glucose, "bitter almond oil" (q.v.), and hydrocyanic acid; *Arbutin* ($C_6H_{10}O_7$), yielding glucose and hydroquinone ($C_6H_8O_4$); *Salicin* (q.v.), $C_{18}H_{28}O_7$, yields glucose and saligenin ($C_7H_8O_2$); *Myronic Acid* ($C_{10}H_{16}NS_2O_{10}$), the potassium salt of which yields glucose, allyl mustard oil, and hydrogen potassium sulphate, the decomposition being effected by means of a ferment—



Ruberythric Acid, $C_{28}H_{28}O_{14}$, occurring in madder, etc., which by the action of hydrolysis yields glucose and alizarin (q.v.).

Glue consists of an impure form of gelatine (q.v.), and possesses generally the properties of that substance. It is manufactured chiefly from bones, which are ground coarsely and then digested with a dilute acid until soft, being afterwards freed from acid by thoroughly washing with water. They are then placed in large iron vessels known as digesters, in which they are subjected for some hours to the action of steam of from 2 to 3 atmospheres pressure—the resulting liquor, consisting of water, glue, fatty materials, etc., being then run off by pipes into tanks, from which the fat is skimmed and used for manufacture of soaps and greases. The liquor which remains is filtered through wire gauze, concentrated by boiling, and run into moulds to set, after which the cakes are dried at about 60° to 70° Fahr., and are then ready for storing for the market. If required to be of the best quality, the glue is bleached before concentrating, when it is obtained of a pale yellow colour. The bones left in the digesters are usually allowed to dry, and utilised for bone manures. The different varieties of liquid glues generally consist of gelatine, either pure or not, dissolved in acetic or some other acid, the solution forming a strong cement, which may be used for pottery, glass, etc.

Glume, a rigid or chaff-like bract in the inflorescence of grasses and sedges, whence the two orders *Graminaceæ* and *Cyperaceæ* are united into one series under the name *Glumifloræ*. These glumes were at one time thought to represent perianth-leaves. They are often green at first, and are sometimes furnished with a terminal or with a dorsal awn (q.v.). The innermost glume, or *pale*, is commonly colourless and transparent, with two longitudinal green veins, so that it probably represents the union of two such organs.

Glutamin, a compound of composition $C_5H_{10}N_2O_3$, resembling "asparagine," and which occurs with this substance in beet-root.

Glutaric Acid, a dibasic acid, the formula being represented by $COOH \cdot CH_2 \cdot CH_2 \cdot CH_2 \cdot COOH$. It crystallises in large soluble monoclinic plates, melts at 97° , and boils at 313° . Its synthetic preparation proves its constitution, and it is of much theoretical interest, owing to the ready manner in which it may be converted into "pyridine" derivatives, and to the synthesis of the vegetable alkaloid piperidine by its use.

Gluten. If flour be kneaded under water, the starch is washed out, and a sticky mass remains—

the gluten. When partially dried but still possessing some moisture, it is a tough, translucent, elastic, and tenacious mass, but if thoroughly dried it becomes brittle, and cannot again be made plastic by the addition of water. It is of great importance in bread-making, and owing to its adhesive nature, when yeast is added and carbonic acid gas formed, the bread expands and becomes porous. It is insoluble in water. It contains about 80 per cent. of a *fibrin*, and about 20 per cent. of *glutin*, probably another albuminoid, the formula for which is not yet established. Ordinary flour contains as a rule about 12 per cent. of gluten.

Glutin. [GLUTEN.]

Glutton (*Gulo luscus*), the largest of the weasel family, and the sole species of its genus. It is a native of the northern parts of both hemispheres, and the American form is generally called the Wolverine. The body is thick-set, with short limbs, and a broad, rounded head; the total length is a little over three feet, of which something less than a quarter goes for the tail. The chestnut-brown under-fur varies much in quality, but when fine and glossy is highly valued; the longer hair is dark-brown or black with a pale reddish-brown band on each side. There is no anal pouch, but the animal emits a musky-smelling liquid when attacked. Gluttons are flesh-feeders, preying on smaller mammals, especially on fox-cubs, but they do not disdain to steal the bait from hunter's traps. These animals are not more glutinous than other carnivores, and the tales told of their ferocity have no foundation in fact.

Glyceric Acid, a monobasic acid of composition $C_6H_8O_4$, which is obtained by the oxidation of glycerine by means of nitric acid, one of the alcohol groups being oxidised to the acid group, as represented by the equation



It may be obtained also by many other reactions. It forms a soluble, syrupy, uncrystallisable liquid. As ordinarily prepared it is an inactive substance, but from it two very similar acids may be obtained, the one dextro- and the other levo-rotatory. [POLARISATION.] If heated to 150° it decomposes, and on fusion with potash gives acetic and formic acid.

Glycerine, or **GLYCEROL**, when pure, is a thick, white, viscid liquid, possessing a very sweet taste, hence its name. It is heavier than water, (specific gravity 1.265), but readily mixes with it. It soon absorbs moisture from the atmosphere, and in damp air may increase in weight greatly, absorbing half its mass of water. It is a very good solvent for organic and many inorganic substances. If cooled it may be obtained as a crystalline mass which melts at 17° C. Its composition is represented by the formula $C_3H_8O_3$, and its properties and reactions prove it to be of the nature of a trihydric alcohol possessing two primary and one secondary alcohol groups [ALCOHOL], and represented by the formula $CH_2OH \cdot CHOH \cdot CH_2OH$. If oxidised it yields a number of products, as glycerose ($CH_2OH \cdot CO \cdot CH_2OH$), which resembles

in many respects the sugars; *glyceric acid* (q.v.); tartronic acid, $\text{CHOH}(\text{COOH})_2$, while if the oxidation is more energetic it decomposes into oxalic and other acids. It boils at 290° , but decomposes slightly, giving off a pungent odour owing to the formation of *acrolein*. It may, however, be distilled unaltered under diminished pressure, a fact made use of in its purification. It is present in fats and oils combined with various fatty acids, as stearic, palmitic, etc. From these it is always manufactured, and its production is largely carried on in conjunction with those of candles and soap. In the candle (q.v.) manufacture the fats, etc., are decomposed by blowing in superheated steam. Two liquids are obtained, the one consisting of the fatty acids and the other of a solution of glycerine. These are separated, and the dilute glycerine is purified by distillation under diminished pressure in suitable forms of apparatus. Sulphuric acid is sometimes employed to effect the decomposition of the fats, in which case the glycerine is obtained in combination with the acid and has to be liberated by addition of lime. It is also very largely obtained from a bye product—the *spent lye*—of soap-works. [SOAP.] This contains water, glycerine, and various salts of soda and potash, with a number of various impurities of a resinous and albuminous nature. From this it is obtained by (1) heating with lime and resin, the scum formed being removed by skimming; (2) blowing through hydrochloric acid with the addition of some bleaching-powder to remove sulphur. A liquor is so obtained, containing chiefly a solution of salt and glycerine. This is concentrated when the salt is precipitated, and the crude glycerine is purified by distillation. Very large quantities of glycerine are employed in the production of *nitroglycerine* (q.v.), the basis of dynamite and many other powerful explosives. Mixed with lead oxide it forms what is known as "lead plaster." It is used frequently in medicine as a solvent and for local application. It is also used largely in the chemical laboratory, as a preservative, and also in many manufactures, as in calico-printing, copying-ink, etc.

Glycerol. [GLYCERINE.]

Glycine, or **GLYCOCOL**, is a substance of composition, $\text{CH}_3(\text{NH}_2)\text{COOH}$, i.e. amido-acetic acid. It possesses acid properties owing to the presence of the acid group COOH, but the amido group, NH_2 , bestows upon it basic properties also, so that it can be combined with either base or acid. It forms large crystals belonging to the rhombic system, is soluble in water, and possesses a sweet taste. It may be readily prepared from acetic acid, and by many reactions, and is a product of the decomposition of many animal substances. It is present in the bile combined with another acid, glycholic acid, to form glyco-cholic acid, and is formed also in combination with benzoic acid in the urine of horses (hippuric acid). It is also closely related to the substance Leucine which occurs in many of the juices of the animal body.

Glycocol. [GLYCINE.]

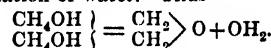
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Glycogen is a white powder closely resembling starch, which occurs in the liver of many animals. It possesses the formula $\text{C}_6\text{H}_{10}\text{O}_5$, belonging to the group of bodies known as carbohydrates. It may be distinguished from starch by its giving a brown colour, instead of a blue, with iodine. If heated with a dilute acid it combines with water, forming dextrose, $\text{C}_6\text{H}_{10}\text{O}_5 + \text{OH}_2 = \text{C}_6\text{H}_{12}\text{O}_6$, while by the action of ferment maltoze is also obtained.

Glycol is the first of the series of "glycols" or dihydric alcohols. Glycol has the formula $\text{C}_2\text{H}_6\text{O}_2$ or $(\text{CH}_2\text{OH})_2$. It is a thick colourless liquid of specific gravity 1.125, which dissolves in water in all proportions. It possesses a sweet taste, hence its name (Gr. *glykys*, sweet). If oxidised it yields first an acid of composition $\text{CH}_2\text{OH}, \text{COOH}$, glycollic acid, but on further oxidation the second alcohol group is also attacked, while intermediate aldehyde products, as glycoxal, CHO-CHO , and glyoxilic acid, CHO-COOH , are also produced.

Glycollic Acid. [GLYCOL.]

Glycols are a series of compounds which may be represented by the general formula $\text{C}_n\text{H}_{2n+2}\text{O}_2$, and may be regarded as derived from the paraffins by the replacement of two hydrogen atoms by two hydroxyl (OH) groups. They hence contain two alcohol groups, and are to be regarded as dihydric alcohols. According to the nature of the groups they may form *diprimary*, *primary-secondary*, etc., alcohols (q.v.). They are all thick viscid liquids with a sweet taste, soluble in water, and exhibit a gradation in properties as the number of carbons increase. They form salts or glycollates with sodium, etc., and form ethers (q.v.) with acid radicals. They also readily form oxide owing to the elimination of water. Thus—



Glycosuria, a name given to the disease in which sugar (glucose) occurs in the urine.

Glyoxal. [GLYCOL.]

Glyptodon, a genus of gigantic fossil armadillos, found in the Pleistocene fluviatile deposits of the Argentine Republic. The head, trunk, and tail are covered with bony plates, almost hexagonal and united by sutures; but there are no bands in the armour, so that the animals could not roll up like recent armadillos. The vertebrae are almost all fused together into one bony cylinder, and the feet are massive. These animals, in some cases, reached over 9 feet in length. With four related genera, *Glyptodon* forms a distinct family of Edentata (q.v.), the *Hoplophoridae*.

Gmelin, LEOPOLD (1788-1853), a German chemist, was born at Göttingen. He came of a scientific stock, as his great-uncle, JOHANN GEORG (1709-55), was a great traveller and one of the chief botanists of his day, and his father, JOHANN FRIEDRICH (1748-1804), was Professor of Medicine at Tübingen and Göttingen, and left a *History of Chemistry* and other works. Leopold held the chair of Chemistry and Medicine at Heidelberg for many years, and was author of a *Handbuch der*

Chemie (translated by Watts) and several medical works.

Gmelin's Test for bile pigment. The presence of bile pigment in natural or morbid fluids is demonstrated by the peculiar play of colours which is produced on the addition to the fluid of a few drops of nitric acid yellow from the presence of nitrous acid.

Gneisenau, AUGUST WILHELM ANTON, GRAF VON (1760-1831), an able Prussian general, was born at Schildau, in Saxony. He first took service in the Ansbach army, and went to America during the War of Independence as a mercenary in the British service. In 1786 he had a personal interview with Frederick the Great, who gave him a commission in the Prussian army. He was present at Jena, and distinguished himself as chief of the garrison at the siege of Colberg (April-July, 1807). During the dark days of Prussia he busied himself with schemes for reorganising her army, and in 1809 Napoleon compelled him to resign. While in retirement he continued his plans, and called upon Europe for help. During the War of Liberation he was quartermaster-general to Blücher, and in the Waterloo campaign was his second-in-command. He was named Field-Marshal in 1825, but his Liberal opinions kept him in the background. He was a great force in his own province of Silesia, where he died of cholera. There are lives of him by Pertz and Delbrück.

Gneiss, a foliated rock, composed essentially of orthoclase felspar, quartz, and mica. Bubble-cavities containing water and liquid carbon dioxide occur in the quartz; plagioclase felspars and garnet are common accessory minerals, and hornblende, talc, and graphite are sometimes so abundantly present, replacing in part the mica, as to give names to recognised hornblende, talcose, and graphitic varieties. Lithologically gneiss hardly differs from granite (q.v.), except in its foliation (q.v.), and some of the coarser varieties do not exhibit this structure in hand-specimens. Gneiss is said to graduate in the field either into mica-schist, slates, or less altered sedimentary rocks; or, on the other, into true granite. It has been generally considered a highly metamorphosed aqueous rock; but may, at least in some cases, be a granite, molecularly rearranged. Most gneiss is associated with Archean rocks (q.v.).

Gneist, HEINRICH RUDOLF (b. 1816), German jurist and historian, was born at Berlin. Till 1850 he held judicial posts, but after that time devoted himself chiefly to writing and teaching. In 1844 he became Professor of Jurisprudence at Berlin, and in 1858 a member of the Prussian Diet. He was afterwards also elected to the Reichstag. His chief works are *The Constitution of Trial by Jury in Germany*, *The Administrative Law in England*, and *History of the English Parliament*. He was political instructor of the Emperor William II., and in 1875 became Senior Judge of the Supreme Court of Prussia and a Privy Councillor. He died in 1895.

Gnome, an imaginary being supposed to inhabit the interior of the earth, and to be the guardian of

animals, vegetables, and especially of minerals and mines.

Gnomon, in *Geometry*. If a parallelogram is divided into four parts by two lines parallel to its sides intersecting at a point on either diagonal, and if one of these four parts be removed which is cut by this diagonal, the remaining three constitute a gnomon. The term is also used to denote the rod of a sundial that is placed parallel to the axis of the earth, and whose shadow marks the time on the dial.

Gnosticism, a system of belief which attempted to combine Christian doctrines with elements derived from Greek philosophy, Judaism, and Oriental religions. The Gnostics were so called because they laid claim to knowledge (Greek *gnosis*) of a special kind concerning the mysteries of the Divine nature. Gnosticism reached its most vigorous state about the middle of the 2nd century, and died out in the latter part of the 4th century. Its main principles were everywhere the same, but the doctrines based upon them differed considerably in the various sects. The following were the cardinal points of the system:—There is one Eternal and Supreme Deity, who dwells apart from the *hyle* or material world in the midst of a *pleroma* or fulness of light. From Him there emanate numerous *Æons*, representing for the most part certain attributes of Deity, such as Wisdom, Truth, and Might. The *Æons* partake in a varying degree of the Divine nature, and low down in the scale is the Demiurgus, the creator of the visible world, who was identified with Jehovah, the God of the Old Testament. Those Gnostics who were influenced by Zoroastrian doctrines held that the Demiurgus is the evil principle in the universe, and that he is engaged in a perpetual conflict with the Supreme Deity, the source of all good. All the schools recognised a three-fold division of mankind—the "spiritual," who have an insight into the Divine nature; the "terrestrial," who are under the dominion of matter; and a third class, who are subject to the laws imposed by the Demiurgus for the attainment of his own ends. As matter is essentially evil, there is no resurrection of the body. For the same reason the doctrine of the Incarnation, which involved the combination of the divine nature with a material body, was rejected, and either the divine or the human attributes of Christ were explained away. The Ebionites, Basilidians, Carpocratians, and Cerinthians held that He was a man, and that the Divinity descended upon Him at His baptism in the form of a dove, leaving Him before the crucifixion. The Saturninians, Encratites (followers of Tatian), and Marcionites, on the other hand, maintained that the body of Christ was an unsubstantial phantom; while the Bardesanians and Valentinians asserted that it was composed of the same elements as those of the angels. The redemption was represented as a communication to mankind of the *gnosis*, which delivered the spiritually-minded from the bondage of the material world. These general principles gave rise to two widely different views of conduct. Some endeavoured by a severely ascetic life to maintain a rigid self-control, which would deliver them from the influence of the

hyle or the Demiurge, while others held that for those endowed with *gnosis* all actions were indifferent, and expressed their contempt for matter by giving free vent to their animal appetites. In so far as they accepted the Old Testament, the Gnostics interpreted it in a symbolical sense. For the most part, however, they refused to recognise it at all, and they gradually rejected the greater part of the New Testament also, substituting certain apocryphal books and spurious gospels of their own.

Gnu, any antelope of the South African genus *Catoblepas*. There are two species—*C. gnu*, the common, and *C. gorgon*, the brindled gnu. They are strange-looking animals: the neck is arched, with a hog-mane, the body and tail are not unlike those of a small pony, with deer-like limbs, and a buffalo-like hairy head, long beard, and hair between the forelegs. Both sexes bear horns. The common gnu is brownish-black, with white mane and tail. The brindled gnu, the larger species, is dun, with pale streaks. Gnus are said to be fierce, but the common species is domesticated without difficulty when taken young.

Goa, a city and territory on the Malabar coast of Hindostan, about 250 miles south of Bombay, with an area of 1,262 square miles. It was captured by Albuquerque in 1510, and is still held by the Portuguese. Rice is largely grown, but part of the province is covered by forest. At Goa are a fine cathedral and a church in which Xavier was buried; but the seat of government is at Panjim or Nova Goa, three miles farther west. In 1871 there was a rebellion, after which the native army was disbanded. The inhabitants are a mixed race, and are very dark-featured. A Portuguese patois is the usual language, but in a few families pure Portuguese is spoken. Roman Catholicism is almost universally professed.

Goajires, a large and independent nation in the State of Colombia, where they occupy the whole of the peninsula named from them, which projects between the Gulf of Venezuela and the Caribbean Sea; area 2,600 square miles. The Goajires, who are the Guajiros of the early Spanish writers, have maintained their autonomy in this region ever since the close of the 16th century, when they revolted against their white taskmasters, and expelled them from the country. They are a handsome race, robust and agile, with round face, almost regular features, black hair hanging in ringlets down to the shoulders, and of a brick-red complexion growing with years to a deep mahogany. The Goajires are hunters, fishers, dealers and traders, supplying the settled communities beyond the frontier with much local produce—cattle, fish, turtles, timber, dye-woods, salt, and corn in exchange for cotton fabrics and other manufactured wares. Their language shows strong Carib affinities, and the Goajires, who call themselves Guayu, are generally regarded as a branch of the widespread Carib family. (R. Paez, *Wild Scenes in South America*, New York, 1863; A. Ernst, *Die Goajiro Indianer in Zeitschrift für Ethnologie*, 1870.)

Goat, any individual or species of *Capra*, a genus of hollow-horned ruminants, almost exclusively confined to the rugged and mountainous parts of the Palearctic region, outside which only two species (one in Abyssinia and one in southern India) are found. Goats are closely allied to sheep, and the two groups have so many characters in common that it is difficult to frame definitions that shall mark them off clearly. The chief distinguishing marks of the goats are the laterally-flattened horns, keeled or with transverse ridges rising from the top of the head and curving backwards, the absence of tear-pits, the presence of a beard, and a peculiarly strong odour, especially in the males. To these must be added what Hodgson calls the "moral" distinctions: the "curious, capricious, and confident" nature of the goats, as contrasted with the "incurious, staid, and timid" disposition of the sheep. Not only do sheep and goats produce hybrids, but these hybrids are capable of perpetuating the mixed breed.

The domestic goat (*C. hircus*), with its numerous breeds, is probably derived from (*C. aegagrus*) the Bezoar goat, ranging from the Grecian Archipelago, where it is called the Ibex, to Persia, where its name is Paseng. It is of a greyish hue, shaded with reddish-brown, and has a dark dorsal stripe. The male stands about 33 inches at the withers, and the horns, which bear protuberances in front, may measure as much as 4 feet along the curve. The female is smaller, and has the horns less developed. It is said of this animal and of the Alpine Ibex that when accidentally falling they occasionally use their horns to break the shock.

Goats are hardy creatures, and will pick up a subsistence where sheep would starve; but they browse on shoots, twigs, and bark, and if kept near plantations will do a great deal of damage therein. A good she-goat will yield about two quarts of milk daily. The milk is made into butter and cheese, especially in mountainous countries and in the East. The flesh of young goats, or kids, is eaten; goat-skins make excellent rugs, and when dressed as leather are used for making gloves and boots; the horns are utilised for handles for cutlery; and from the fat excellent tallow is produced. Judges and barristers' wigs are made of goats' hair, and from it ropes are spun that resist the effect of water. The Angora goat—a variety from Asia Minor—has long silky hair, from which camelias are made. The Cashmere goat, another variety, is a native of Tibet and Bokhara, and owes its popular name to the fact that its long hair is sent to Cashmere to be made into the celebrated Cashmere shawls. From these two varieties a third has been produced by crossing which yields longer and finer wool than the Angora or the Cashmere. The Syrian goat—a common Eastern form—is noticeable for its very long ears. The Markhore (*C. megacephala*), a wild goat from Cashmere and North-East India, is bluish-grey, with a long beard and mane, and immense spirally-twisted horns. It is popularly said to kill and eat serpents. The Tahr (*C. jamalaica*), from the Himalayas, is a fawn-brown with long hair on the neck, chest, and shoulders. The horns are only about a foot long.

The Ibexes from the mountains of Europe and Western Asia are sometimes made a separate genus, from the fact that the horns are not keeled as in the true goats but have a series of transverse ridges in front. They are sometimes marked off into species, according as they are found in the Alps (*C. ibex*), the Pyrenees (*C. pyrenaica*), the Sierra Nevada (*C. hispania*), or the Caucasus (*C. caucasica*), but the first-named and the Paseng (*C. agagrus*) are probably the only good species. [ROCKY MOUNTAIN GOAT.]

Goat Moth (*Xyleutes cassus*, Linn.), a large moth having an expanse of wing of about four inches; it has a characteristic odour from which its name is derived. The caterpillar, however, is much better known than the moth; it has a large and reddish or flesh-coloured body and black head. It is well known owing to the damage it does to trees and gate-posts or other wooden erections. It burrows through these, and as several usually occur together, and they live for three or four years before entering the chrysalid stage, they often cause the complete destruction of the timber to which they have gained access.

Goatsucker, any bird of the Passerine family Caprimulgidae, with 17 genera containing 91 species. The Cuvierian and scientific names perpetuate the memory of an erroneous popular belief, dating from the days of Aristotle, that these birds suck the milk of goats. Goatsuckers are twilight insectivorous birds, owl-like in appearance, taking their prey on the wing. The gape is very wide, and set with bristles along the margin of the short-curved bill; the hind toe can be directed forward, and (except in the South American genus *Nyctibius*) the middle claw is serrated, though the purpose of this is not known. The plumage of all is exceedingly soft, generally shades of brown and grey, with delicate markings. The flight is swift and noiseless, and the cry weird—that of some species strangely resembling human utterance. [WHIP-POOR-WILL.] The common goatsucker (*C. europaeus*) about ten inches long, widely distributed on the Continent, Asia, and North Africa, visits Britain in May, frequenting woody places, heaths, and fern-covered tracts, rearing its brood, and returning southward in September. From its haunts it is called the Fern-owl, and from its cry the Night-jar, Night-churr, or Churn-owl. The Podargidae, or frog-mouths, chiefly from Australia, are closely allied to the goatsuckers, but are slightly larger, and have a wider gape. [GUACHARO.]

Gobelin, JEHAN (d. 1476), the first of a family of dyers, came to Paris about 1450, and there made a fortune. He built a house which was called *La Filie Gobelin* by people who thought his extravagance would ruin him. The family, however, continued to flourish, and in the 17th century began the making of that tapestry which has made their name famous. In 1662 the establishment was purchased by the Crown, and it is still carried on.

Goblin, the Kobold of German folk-lore, a capricious or mischievous spirit, a gnome. [BROWNIE.]

Goby, any fish of the genus *Gobius*, type of an acanthopterygian family (Gobiidae) of small shore fishes common on temperate and more so on tropical coasts. Some frequent estuaries, and a few live in fresh water. In the type genus the body is scaly, there are two dorsal fins, and the ventrals are united to form a sucking disc, by which these fish can fasten themselves to rocks. The males of some species are not only nest-builders; they also watch over the nest after the young are born. There are about 300 species, several of which are British. The largest of these is the Black Goby (*G. niger*), and is about 5 inches long. Like the other British forms, it is often taken with a net in rock pools, and all these are frequently kept in aquaria. The White Goby (*Latrunculus albus*), a small transparent fish with teeth in one row, common in some parts of Britain and the Continent, is said to be the first recorded instance of an annual vertebrate, for the life-term is a single year. The same peculiarity has been observed in allied American genera (*Aphyia* and *Crystalligobius*).

Godars, an outcast community, province of Mazanderan, Persia, of unknown origin. They are of darker colour than the Persians, and many of their customs resemble those of the Kols, Bhils, and other non-Aryan peoples of Central India. They are nominal Mohammedans, and now speak the Mazanderan Persian dialect. (Napier, *Tour in Khorasan*.)

Godavari, a river of India, rises in the Western Ghauts near Nasik, and flows 898 miles in a south-easterly direction, till it discharges itself by seven mouths into the Bay of Bengal between the towns of Rajamundry and Masulipatam. Its breadth from where it is joined by the Pranbita to its separation into three streams varies from one to two miles, and the beautiful scenery of its lower courses has gained it the name of the Indian Rhine. There are three rapids in its upper course. The country forming its delta raises abundant crops. The Godavari is one of the twelve sacred rivers of India, and each of its mouths is considered holy.

Goddard, ARABELLA (b. 1836), one of the greatest of English pianoforte-players, was born near St. Malo. Her taste was formed by Mr. J. W. Davison, to whom she was married in 1860. She made her *début* in London on October 23, 1850. She was thought very highly of in Germany and Italy, and played for the last time in England in 1873, when she set out on a tour to Australia and the United States.

Godfather and Godmother, those who act as spiritual parents towards an infant presented for baptism. By making a *row* on the child's behalf that he will lead a holy life, and *pledging* himself or herself to secure the fulfilment of that vow, the godparent becomes his *sponsor*. At first one only was required, and this is still the case in the Roman Catholic Church, although there are often more. In the Anglican Church two godfathers and one godmother are necessary for the baptism of a

male, and two godmothers and one godfather for that of a female. Parents are no longer forbidden to act as sponsors for their own children by the Church of England. In Catholic countries co-sponsorship constitutes a peculiarly intimate relation (the Old English *gossiprede*).

Godfrey of Bouillon, one of the greatest of the Crusaders, was born about 1061 in Brabant, and died in 1100 at Jerusalem. He served in the wars of the Emperor Henry IV., and was chosen one of the leaders in the First Crusade. When Jerusalem was captured the army wished to make him king of it, but he refused any other title but that of Defender of the Holy Sepulchre. In 1099 he defeated the Sultan of Egypt in the plain of Ascalon, and thus became supreme in Palestine. [CRUSADES.]

Godiva, LADY, wife of Leofric, Earl of Mercia and Lord of Coventry, is said to have obtained from her lord the remission of certain penalties imposed by him on the townsmen by riding naked through the town in the year 1040. There was a stained-glass window commemorating the occurrence in St. Michael's church, and the story used to be recalled to memory in the procession at Coventry fair. Leigh Hunt, Tennyson, and Robert Brough have written on this theme. [COVENTRY.]

Godolphin, SIDNEY, EARL (1645-1712), an English statesman, was born near Helstone, Cornwall. He early became a favourite of Charles II., and entered Parliament in 1668. Ten years later he was entrusted with a diplomatic mission in Holland, and in 1679 began his connection with the Treasury. From this time forward he became one of the most influential ministers, and, though he voted for the exclusion of the Duke of York from the throne, he became Secretary of State in 1684, and when James came to the throne was only transferred from the Treasury to the Household. He was one of the last adherents of James II., but was, notwithstanding, made a Commissioner of the Treasury by William III. In spite of his known intrigues with the deposed king, he remained at the head of the Treasury from 1690 to 1696; and he was reappointed in 1700, though he was almost certainly known to have been involved in Sir John Fenwick's plot. He was appointed Lord High Treasurer by Queen Anne, and held that office for the first eight years of her reign, during which his management of the finances was of inestimable service to Marlborough, whose daughter had married his son. He had no fixed political principles, but was invaluable as an official who was not only able but, so far as is known, also incorruptible. Circumstances caused him and Marlborough to rely upon the support of the Whigs, and during the years 1708-10 the ministry was composed for the first time of one party in the state. Godolphin ranks as one of England's ablest financiers, but cannot be considered to have been a statesman of the first rank. A life of him by the Hon. Hugh Elliot, in which some incidents in his career are very leniently judged, appeared in 1888.

Godoy. [PRINCE OF THE PEACE.]

Godwin, FRANCIS (1562-1633), author of *The Man in the Moon; or, a Discourse of a Voyage Thither*, by Domingo Gonsales, the Speedy Messenger (1638, 1657, 1768), was born in Northamptonshire, and studied at Oxford. Having taken orders and held several benefices, he became Bishop of Llandaff in 1601, and of Hereford sixteen years later. The above-mentioned work shows the author's acquaintance with the Copernican system, and may quite possibly have suggested to Swift the "Voyage to Laputa" in *Gulliver's Travels*. Godwin's other works are forgotten.

Godwin, MARY WOLLSTONECRAFT (1759-1797) wife of William Godwin (q.v.), was the daughter of an Irishman of bad character, who spent large fortune and left his daughters to go out as governesses. She met Godwin and Thomas Paine in London in 1791. Next year she went to Paris and made the acquaintance of an American name Imlay, with whom she lived for four years. When deserted by him she threw herself into the river at Putney Bridge, but was taken up by a passing boat. A few months after their separation she formed a connection with William Godwin, and though both disapproved of permanent unions, they were married before the birth of Mary, afterwards the wife of Shelley. Her name is now chiefly remembered by her *Vindication of the Rights of Women* (1792), the earliest demand for "women's rights"; but her *Letters Written in Norway, Sweden, and Denmark* have some merit.

Godwin, WILLIAM (1756-1836), author of *Political Justice*, was born at Wisbeach, being the seventh child of a Nonconformist minister. He was educated in Norfolk, whether his father had moved, but in 1773 came to London and entered Hoxton Academy. He next became a preacher and held strong Calvinist views for some years. In 1783 he finally settled in London and engaged in literary work. While writing *Political Justice* he became an atheist, but afterwards professed belief in a vague Theism. The work was very successful, and had much influence on the young men of the day. Godwin was in general sympathetic with the most advanced Whigs, and was intimate with Paine, Holcroft, and Horne-Tooke. He refused, however, to be a party hack; and Mackintosh, D. Parr, and others, who agreed with his politics, attacked his social views. These were further expounded in *Caleb Williams*, a novel (1794) which had some merit of style. Godwin first married in 1796 Mary Wollstonecraft (or Imlay), but lost her within a few months. In 1801 he married a Mrs. Clairmont, and supported not only his children by her and his first wife, but also the children by former husbands. In 1799 he published *St. Leon*, another novel, which had some success, and about this time had a controversy with Malthus (q.v.). In 1805 he and his wife set up a publishing business; but, in spite of the help of Lamb and others and the sums given or lent him by Shelley and Wedgwood, he never earned more than a competence until in 1833 he obtained a sinecure from the Whig Government. The chief work published by him in his later years was

History of the Commonwealth, in the composition of which the pamphlets in the British Museum were first utilised. As a dramatist Godwin failed significantly, but obtained some success as a writer (under a pseudonym) of *Fables* for children.

Godwine (d. 1053), Earl of the West Saxons, an early English statesman, is said to have been the son of a certain Wulfnoth. Neither his parentage nor the date of his birth are, however, certainly known; but early in the reign of Cnut he was a powerful personage. He was made by him Earl of Wessex, and became the second man in the kingdom. He supported Harthacnut, but afterwards accepted Harold I. He used all his influence in the Witan to get Edward the Confessor elected king, and now became head of the English party in the kingdom. His daughter Eadgyth (Edith) was married to the king in 1045, but the Normans soon began to undermine his influence and the lawless deeds of his sons Swegen and Tostig were of great use to his enemies. In 1051 the Earl refused to avenge on Dover some insults that had been offered to the Normans, and he and his sons were outlawed. Next year he landed in the south, and was supported by the country-side. He sailed up the Thames, and, the Witan declaring him innocent, Edward gave him the kiss of peace. He died in all probability of an apoplectic fit.

Godwit (*Limosa*), a universally distributed genus of Scolopacidae. The species are not unlike curlews, but the bill has a slight upward, instead of a downward, curve. The females are larger than the males. They frequent marshes and estuaries, and feed in snipe-fashion by plunging their bills into the mud in search of worms and molluscs. Two species are English visitors: the black-tailed (*L. belgica*), and the bar-tailed godwit (*L. lapponica*). The former used to breed in England.

Goethe, JOHANN WOLFGANG VON, the brightest star in the literary firmament at the end of the eighteenth and the beginning of the nineteenth century, was born at Frankfort-on-the-Main on the 28th August, 1749. Though of humble descent on his father's side, his paternal grandfather having been a journeyman tailor, his grandfather on his mother's side, who stood godfather to him, and after whom he was named, held a high position in society, being Imperial Councillor and chief magistrate of his native city. The poet's own father, however, rose to be a lawyer of considerable distinction and took his degree of Doctor of Laws at the University of Giessen, and being a man of remarkable attainments, great common sense, and, moreover, of a retiring disposition, he was able to exercise a close supervision over the studies of his sole surviving son, whose character was to a great extent moulded and purified by such unremitting control.

But notwithstanding all this influence, apparently for good, young Goethe's education was conducted "not wisely but too well." For a youth of an impressionable and all-devouring nature, receiving and assimilating every production of literary genius, it was highly dangerous to wander, as he

did, over so wide a range of subjects, sipping the sweets of each, but exhausting the resources of none. The study of mathematics, music, languages, both ancient and modern, law, literature, and art in all its branches was surely sufficient to ruin anyone of a less robust mind than the young citizen of Frankfort. Lewes, in his *Life of Goethe*, tells us that he knew several handicrafts, and even learned the art of basket-making. But his wise and farsighted mother kept him to some degree in check. In due course, at the age of 16, he was considered sufficiently advanced in his general studies to proceed to the university, and was entered at Leipsic in 1765 with the ostensible object of continuing his study of law. Leipsic was at that time the headquarters of the literary army, whither flocked the poets, critics, historians, and scientists of the day, the chief among whom were Gellert and Winckelmann; and Goethe—inwardly rejoiced to be free from the trammels of a somewhat pedantic and humdrum home life—absorbed and assimilated impressions from without and, remodelling and reconstituting them, gave them to the world in a new dress in the various forms of pastoral (*Die Larne des Verliebten*—*The Lover's Caprice*), comedy (*Die Mitschuldigen*—*The Fellow-Sinner*), and prose (*Confessions*). At Leipsic he remained little over three years, when a somewhat severe illness, brought about by excesses and low diet, occasioned his return to Frankfort. From this illness he speedily recovered, but a gloomy melancholy settled on his mind, and mysticism and theosophy for a time hampered his progress to a higher sphere.

A turning-point in Goethe's career took place, however, when he entered in 1770 the University of Strasburg and made the acquaintance of Herder, then initiating a new departure in the realm of poetry. We refer to that epoch in the literature of Germany, styled, after a drama of Klinger's, the *Sturm und Drang* (or *Storm and Stress*) period, which lasted from 1767 to 1781, and of which Herder was the most striking exponent. It was an attempt to supplant the poetry of art by the poetry of nature, to go back to the earliest periods, when the poetry of the people sprang from the heart of the people, and the false, the artificial, the manufactured, the studied was to be a thing of the past. Here, too, Goethe had his first serious love affair with Frederike Brion, the daughter of a neighbouring pastor, which, though little more than a youthful fancy, inspired some of his noblest lyrics. At Strasburg he took his degree of Doctor of Laws in due course, and returning to Frankfort in 1771 completed his legal education at the court of the Imperial Chamber in Wetzlar. On his return to his native city he brought out in 1773 his first work of any importance, the drama of *Götz von Berlichingen*, the most brilliant outcome of the new ideas, and a severe shock to the adherents of the old French school. In it Goethe presents to us vivid pictures of the Peasants' War and the *Vehmgericht* or Secret Court of the Middle Ages. Shortly afterwards followed the *Sorrows of Werther* (*Die Leiden des jungen Werther*), the disburdening of a mind at that time full of

melancholy thoughts. This work created a great sensation, and Napoleon is said to have carried it with him on his campaigns. It was succeeded by a number of minor productions, chief among them being the tragedy of *Clavigo*. Goethe now sought consolation for an unhappy love affair in a journey to Switzerland and commenced on his return the tragedy of *Egmont*. It was during this period, too, that his grandest conception, *Faust*, issued first as a fragment and subsequently as a tragedy, was springing into life and assuming the noblest proportions under the hand of a master.

And now came an important period in Goethe's career. Previous to his journey to Switzerland he had, at their request, been introduced to the young Princes of Weimar by Major von Knebel, the friend and mentor of the younger, and in 1775 Charles Augustus, having come of age and entered upon the government, invited the poet to his court at Weimar. Hitherto his mother, the Regent Anna Amelia, had been one of the most zealous patrons of literature, and to her select circle, among whom only Wieland, Herder, and subsequently, from 1799 till his death in 1805, Schiller need be mentioned, we may be sure that Goethe was a most welcome addition. It was here, too, that he met Frau von Stein, who exercised a considerable influence over her admirer. At the court of Weimar he held for some time an inferior position, until in 1779, at the age of 30, he received the appointment of Privy Councillor. Three years later he was made President of the Chamber and enrolled among the lower nobility (*i.e.* those who receive the title of *von*); but the poet felt that he could not give his heart to the dull routine of official business, and that his interests lay in another direction. His generous patron, who appreciated his feelings, gladly therefore accorded him a lengthened leave of absence, and he was enabled in 1786 to fulfil a yearning which for some time past had taken complete possession of him, that of visiting Italy. For various reasons, however, he kept his destination a secret from his friends, and, as he himself tells us, "stole forth from Carlsbad" to the land of song. Here he remained for about two years, visiting Venice, Rome, Naples, and Sicily, of which he has given us a most remarkable description in his two books the *Italienische Reise* (1814) and *Italien*, collections of extracts from letters to his various friends. In Italy alone was he able to study art and nature in its purest and sublimest forms, while his literary genius by no means lay dormant. Previous to his departure he had brought out four volumes of his collected works, and while engaged in the issue of the remainder he rewrote in the form of verse his *Iphigenia auf Tauris* and *Torquato Tasso*, both originally composed in prose, and completed in Rome his tragedy of *Egmont*, besides several other minor productions.

On his return to Weimar studies in natural science engrossed his attention, and he began to feel that the life of a court official was highly unsuitable to his tastes. The French Revolution, too, made a deep impression on his sensitive nature, filling his mind with gloomy forebodings,

and in his *Reinecke Fuchs*, an adaptation of an ancient fable, he gave vent to a feeling of bitter resentment against mankind. About this time appeared the first instalment of *Faust*, but receptive as men's minds were for revolutionary ideas, this undue exaltation of supernatural powers met with no very cordial reception. Gradually, however, its purport came to be better understood, as realising the workings of the poet's mind. In 1794 appeared the first volume of *Wilhelm Meisters Lehrjahre* (apprenticeship), notable, among other excellencies, for the finest criticism of *Hamlet* extant. The first six books of this work were, however, written before his departure for Italy. This year was an important epoch in the poet's life, as marking the commencement of his friendship with Schiller, which lasted till the death of the latter in 1805. Goethe contributed largely to periodicals issued by his friend, and some of these publications having met with an indifferent reception, they resolved to take vengeance on their critics and exposed the degraded literary taste of the day in a series of epigrams called *Xenien*, which created at the time a profound sensation. The novel of *Wilhelm Meister* was completed two years after the issue of the first part, and was followed by *Hermann und Dorothea* in 1797. This is an "idyllic poem" in hexameters founded on an episode in the career of some Salzburg refugees, but transported to the period of the French Revolution. For some time past Goethe had been endeavouring, in conjunction with Schiller, to introduce reforms on the German stage, and himself undertook the management of the Weimar Theatre. Although nothing of importance appeared after the death of his friend, unless we except the second part of *Faust* and the first edition of *Wilhelm Meisters Wanderjahre*, a work much inferior in every respect to the *Lehrjahre*, his literary activity was never allowed to slumber. Many of his former publications were revised, and his Italian correspondence collected and collated. With the words "More light!" on his lips, he passed away peacefully on the 22nd March, 1832, at the age of 83 years.

The greatness of Goethe's genius no one will call in question. Before his appearance German literature was at its lowest ebb, nothing worthy of the name having appeared since the earliest traditions of the nation embodied in the *Lay of the Nibelungs*. Goethe marked the beginning of a new epoch, stimulating and furthering the tastes of the nation not only by what he himself produced, but by the all-pervading influence of his personal character. A man of such universal genius—genius not impaired by its universality—is a rare phenomenon. Science, literature, art, all came within his ken. It is owing to the fact that he was able, as Emerson expresses it, to cope with a rolling miscellany of facts and sciences, and by his own versatility to dispose of them with ease, that he exercised such a vast and beneficial influence over the literature of his country. (For a full account of his life and works see G. H. Lewes' *Life of Goethe*, a standard work, and Dünzer's *Life of Goethe*, translated by T. W. Lyster.)

Goffe, or GOUGH, WILLIAM (d. 1679?), a notable historical and legendary character of the 17th century, was an officer in the Parliamentarian army during the Civil War. He was prominent at the meeting of officers which decided to bring Charles I. to trial, and, as one of the king's judges, signed the death-warrant. He was one of Cromwell's major-generals, and a member of the new House of Lords, and received a grant of Irish land for his services. When at the Restoration he was excepted from the Act of Indemnity, he escaped to Massachusetts, but even there had to remain in hiding. Tradition says that when in 1675 the station of Hadley was attacked by Indians he suddenly appeared and rallied the settlers—a story made use of by Scott (*Peschil of the Peak*) and Fenimore Cooper.

Gog and Magog, names given to the giants in the Guildhall. The figures now to be seen were made in 1708, the old ones, which dated from the reign of Henry V., having perished in the Fire of London. There are various stories about them, but in Caxton's story Gog and Magog are the last two descendants of a race of giants who were conquered by Brut the Trojan, who made the two prisoners porters in his palace in London. In the Bible Magog is sometimes a man and sometimes a country, as in Ezekiel (xxxviii.). In Revelation (xx.) Gog and Magog together represent the nations opposing the triumph of the Kingdom of God. The Gog-Magog hills, near which there are traces of a Roman camp, are in south-east Cambridgeshire.

Gogol, NICOLAI VASILIEVITCH (d. 1852), a Russian realistic writer, was born at a village in the province of Poltava in 1809 or 1810. He went to St. Petersburg in 1829, hoping to earn a living by his pen, and two years later became known by his *Evenings in a Farm near Dikanda*. In 1834 he issued a second series, some of the tales in which have been translated into English. In 1837 appeared his *Dead Servs* (translated into English in 1887), a picture of provincial life which is considered Gogol's *chef-d'œuvre*. A year before he had satirised Russian officialism in a comedy, *The Revising Inspector*. He had himself had some experience of office, and he also lectured at St. Petersburg on history. He lived abroad (chiefly in Italy) for some years, but returned to Russia in 1846, and died at Moscow in 1852. His correspondence and collected works were published in six volumes (1856-57). Gogol was intimate with Pushkine, who had much influence on his writings. His popularity in Russia was second only to that of Turgenieff.

Gohelwar, a district forming the eastern coast of Kattiwar Peninsula, Presidency of Bombay. It has an area of about 4,000 square miles.

Goitre, BRONCHOCELE, the term applied to diseases of the thyroid body. The thyroid body or gland is situated in the neck, and consists of two lobes, with a connecting middle lobe or isthmus, which lies just in front of the windpipe. The gland substance is richly supplied with blood-vessels,

and consists of a number of vesicles (thyroid vesicles) which are filled with a transparent material (colloid substance). Isolated cases of goitre are met with in all parts of the world, but the disease occurs with especial frequency in certain localities, in which places it is therefore said to be *endemic*. In the Swiss valleys, and in certain parts of the Himalayas, goitre is common. In England it is much more rare, but affects certain counties, notably Derbyshire, whence the name "Derbyshire neck." Apart from the disfigurement caused by the tumour, goitre may produce certain serious consequences, notably, it may give rise to symptoms caused by the pressure exerted upon important structures, which lie in the neck in close juxtaposition to the thyroid gland. The most frequent "pressure effect" produced by a thyroid tumour is constriction of the trachea or windpipe, leading to difficulty of breathing; this symptom is most commonly associated with enlargement of the middle lobe of the thyroid body. In the treatment of goitre the most effectual remedy is, no doubt, the removal of the patient from the locality in which the disease was contracted; if this be impossible, attention should be directed to the water supply, as there is little doubt that it is through the medium of drinking water that the disease is produced. Cysts may be evacuated by puncture. When the trachea is compressed and asphyxia is imminent, tracheotomy may be called for, and in some instances the attempt has actually been made to extirpate the whole tumour; this latter proceeding involves no little danger, so richly, as a rule, is the swelling supplied with blood-vessels.

Goklāns, a large division of the Turkoman people, whose territory lies in the Upper Attrek and Gurgan river valleys between Kizil Arvat and Askabad on the Russo-Persian frontier. Chief *taïf* (subdivisions): Chakir, Begqli, Kazl, Karabalkan, Kyruk, Bajindir, and Yangak, including a branch in the Persian province of Mazanderān.

Golconda, a fortified town in Hindostan, seven miles north-west of Hyderabad. It was formerly the capital of a kingdom of the same name, but is now the chief town of the Nizam's dominions. There were gold and diamond mines in the neighbourhood of the city, and the latter were cut and polished at Golconda.

Gold, a metal valued on account of its scarcity, colour, lustre, and power of resisting oxidation. It is represented chemically by the symbol Au, from its Latin name, *aurum*, and it has an atomic weight of 196·5. It is the only metallic element of a yellow colour. Its hardness when pure is about 2·5, and its specific gravity about 19. It is the most malleable of metals, the thin leaves appearing green by transmitted light. Its weight and malleability serve to distinguish it from many other substances, especially iron-pyrites. Gold is also extremely ductile, and can be welded readily when cold. It does not dissolve in the simple acids, but will do so in aqua regia (q.v.), forming a yellow solution of auric chloride ($AuCl_4^-$). From this solution it is precipitated as a soft brown powder by

ferrous sulphate (FeSO_4), as a dark-brown sulphide by sulphuretted hydrogen, or most characteristically as "purple of Cassius" by stannous chloride (SnCl_2). Gold is chiefly obtained "native," i.e. uncombined; in which state it is sometimes in small octahedral crystals belonging to the Cubic system, sometimes dendritic, or in grains or veins disseminated through quartz-rock; but more commonly in dust-like particles or in rounded water-worn lumps or "nuggets" in alluvial deposits. In accordance with these two chief modes of occurrence, gold-mining is either vein-mining and quartz-crushing, or what is known as "placer-mining." This consists in repeated washings of the auriferous gravel or "pay dirt" in a "pan," "cradle," or "sluice," and passing it over mercury, with which the gold unites or amalgamates. The mercury can subsequently be readily driven off by heat, leaving the gold. The auriferous gravels are sometimes quarried on a large scale by a hydraulic jet. Auriferous quartz-veins occur generally in slates or talcose or chloritic schists: alluvial gold is commonly associated with grains of quartz, platinum, osmiridium, tinstone, chromite, magnetite, zircon, topaz, sapphire, garnet, and diamond. There is hardly a geological formation or a country in the world in which some gold has not been found in one or other of these forms. It occurs in Cornish stream-tin works, in granite in Wicklow, in Sutherland, and in quartz-veins in C沁arathenshire and Merionethshire. At Tchemnitz in Hungary veins occur in Tertiary trachytes, and in Transylvania even in sandstone. The more important Ural workings are both in veins in Palaeozoic rocks and in alluvium of later Tertiary age. From Mexico to Alaska, one of the richest auriferous regions on the globe, the gold is largely in river-terraces of Pliocene or Pleistocene age; but in California auriferous veins also occur in rocks probably of Triassic age. Most of the gold of Africa is alluvial; but auriferous quartz-veins occur in the Transvaal in talc-schists associated with diorite, probably Silurian or Devonian in age. In Australia the vein-gold seems all of Lower Palaeozoic age; but there are also important Tertiary alluvial deposits. Next in importance to the native metal as a source of gold is iron-pyrites, in which the precious metal is probably not chemically combined. Gold also occurs in arsenical pyrites, in galena (q.v.) and with silver in certain tellurides, such as sylvanite (q.v.), calaverite, named from Calaveras in California, and nagyagite, from Nagyag in Transylvania. Most of the gold of Brazil occurs in pyrites. The chief gold supply of the world is at present derived from the United States, Australia producing about three-quarters as much.

Gold-beater's Skin, a membrane prepared from the outside coat of the great intestine of the ox. Its tough consistency renders it suitable for being placed between the leaves of gold while they are being beaten. It thereby becomes extremely thin, and may be afterwards used in dressing wounds.

Gold-beating, the process by which gold is beaten into leaves for gilding. As gold-leaf was

used in the East for gilding (q.v.) at a very early period, the method by which it is prepared must also have been known. Gold-beating was formerly a thriving industry at Florence, but it has much declined there of late years, owing to the production of inferior but cheaper gold-leaf in France and Germany. A considerable amount is made in England, especially in London. The first step in the preparation is to alloy the gold with silver or copper, the amount of which varies with the colour desired. It is then cast into ingots, and each ingot is rolled into a ribbon about $1\frac{1}{2}$ inches wide. These are cut into pieces which are interleaved with squares of coarse paper. A leaf of vellum is introduced here and there instead of the paper. The packet formed in this way, termed a "cutch," is laid on a marble surface and beaten with a hammer weighing about 16 lbs. Much exertion is saved through the elasticity of the vellum, which causes the hammer to rebound. When the pieces of gold have become equal in size with the squares of paper, they are removed and cut into four pieces. These are interleaved with gold-beater's skin so as to form a "shoder," and the same process is repeated, but in this case a 9-lb. hammer is used, and the beating is continued for a longer time. The pieces thus beaten out are in their turn cut up, and a packet called a "mould" is formed by interleaving about 950 of them with fresh gold-beater's skin. A final beating then takes place with a 7-lb. hammer, lasting for four hours. The leaf is thus reduced to a thickness of about $\frac{1}{25000}$ inch. An ounce of gold when beaten out sometimes covers over 200 square feet.

Gold Coast, a stretch of sea-board on the Gulf of Guinea, West Africa, about 300 miles in extent, having the Ivory Coast on the west, and Dahomey on the east. It derives its name from the gold-dust brought by the Ashantis from the interior and sold to traders. The climate is unhealthy, and the coast dangerous owing to the heavy surf. Besides gold, palm-oil, cocoa-nuts, and ivory are objects of barter. The inhabitants consist almost entirely of negroes, governed by their own chiefs; but the whole territory is under the protection of a British Governor residing at Christiansborg.

Golden Apple Beetles, a family of beetles of which the best known English representative is *Chrysomela cerealis* (Linn.). This is of a bright gold colour streaked with bands of blue and green. It is commonest in North Wales.

Golden-crested Wren, a somewhat misleading name for *Regulus cristatus*, the kinglet, a warbler approaching the tits in habit. It is a native of Britain, and numbers also visit us in the winter from the north of Europe, over which continent it is widely distributed. It is the smallest British bird, being little more than three inches long. The plumage is yellowish-green above, and light grey beneath, and the saffron feathers on the crown form a crest; the tints are duller in the hen bird. *R. ignicapillus*, the Fire-crested Wren, is an occasional visitor.

Golden Fleece, in Greek mythology, was the fleece of the ram Chrysomallus, which the Argonauts sought to obtain in their expedition to Colchis. An order of knighthood with this title was instituted by Philip III., Duke of Burgundy, in 1429. The selection of the fleece as a badge is perhaps explained by the fact that the manufacture of wool had long been the staple industry of the Low Countries, then a part of the Burgundian possessions. The office of Grand Master was held by Philip himself, and became hereditary in his family. There were thirty-one knights, who filled up vacancies by co-optation, but the right of election was transferred by Gregory XIII. to Philip II. of Spain, at that time Grand Master. Early in the 18th century a dispute concerning the possession of the order arose between Philip V. of Spain and the Emperor Charles VI., who then held the Netherlands. It was eventually settled by the establishment of the order both in Spain and Austria.

Golden Legend, a collection of lives of the chief saints, written by Jacobus de Voragine (1230-98), who at the time of his death was Archbishop of Genoa. It has been translated from the original Latin into most of the European languages. An English version by Caxton was published in 1483.

Golden Number. The discovery of the Greek astronomer Meton in 432 B.C. that a period of 19 years brought the sun, the earth, and the moon approximately into the same relative positions, furnished a convenient means of marking time. The number of a year in the Metonic Cycle became known as the Golden Number from the circumstance that in the Roman and Alexandrian calendars these numbers were inscribed in gold. When the Gregorian calendar was adopted, the 1st of January of the year 1 B.C., on which day there was a new moon, became the starting-point from which the Metonic Cycles were reckoned. The golden number of a year may therefore be ascertained by adding 1 and dividing by 19; the quotient gives the number of previous cycles, and the remainder the number of the year in the present cycle.

Golden Oriole. [ORIOLE.]

Goldfinch (*Carduelis elegans*), a common European and British finch, valued as a cage-bird for its fine plumage and sweet song. The male, about 5 inches long, has the back and rump dusky brown, mixed with black, the greater wing-coverts gamboge yellow, the nape white, top of the head black, and a crimson patch at the base of the bill. They are generally found in small flocks, and produce two broods in a year. The young are fed on insects, but the old birds are chiefly seed-eaters.

Goldfish, GOLDEN CARP (*Carassius auratus*), a Chinese and Japanese fish introduced in England towards the close of the 17th century. It is naturally brownish, but in a domesticated condition it becomes a rich gold colour. Albinos often occur, and are known as Silver Fish. Both forms are kept in aquaria.

Goldi, a Mongolic people of north-east Asia, Amour basin, settled chiefly along the right bank of the main stream between the Sungari and Gorin confluences, and also in the Usuri river valley. The Goldi, who are a branch of the Tungus race [TUNGUS], are the Yu-pi-ta-tze or "Fish-skins" of the Chinese, being so named from their national costume, a long flowing robe of Chinese pattern made of prepared salmon skins. They live entirely by fishing and hunting, varying their fish diet with a little rice or millet, which they receive from the Manchu and Chinese dealers in exchange for peltries and dried fish. They cultivate no land, and keep no domestic animals, except a few cats, pigs, and a breed of dogs like those of the Eskimo. Nevertheless, they are very fond of animals, keeping menageries of bears, wolves, and foxes, and aviaries of wild ducks, geese, and eagles. The type is distinctly Mongolic, marked by a yellowish complexion, flat features, short stature, and black, lank hair. (Venukof, in *Petermann's Mittheilungen*, 1862.)

Gold Leaf Electroscope, in *Electricity*, is an instrument that estimates the potential of a quantity of electricity by the divergence produced of two strips of gold leaf that hang from the charged conductor. [ELECTROSCOPE.]

Goldoni, CARLO (1707-93), an Italian comic dramatist, was born in Venice, at which place and at Pavia he studied law. In 1732 he produced a successful tragedy, but soon forsook this department of dramatic art for that of comedy. In the course of twenty years he wrote more than 100 pieces, among which were:—*Zelinda e Lindoro*, *La Bottega di Caffé*, *Dama Prudente*, and a trilogy called *Villegiatura*. In 1761 he was engaged to write for the Italian theatre at Paris, and during his residence there taught Italian to the daughters of Louis XV.

Goldschmidt, MADAME (1820-1887), a great Swedish singer, better known as JENNY LIND, was born at Stockholm. In spite of her parents' poverty she had lessons in the Court theatre from the age of nine, and, after a successful *début* at eighteen in *Der Freischütz*, continually sang before royal audiences. In 1841 she studied under Manuel Garcia at Paris, but her first appearance there was a failure. She then studied German at Berlin, to which city she returned after a short stay in Stockholm. In 1846 she sang at Vienna, and in 1847 made her first appearance in London, to which she returned a year later, and again in 1849. She went on an American tour under Barnum's management in 1850-52, and married her pianist, Otto Goldschmidt, in the latter year. On her return to Europe she confined her appearances to concerts and oratorios, and left the stage. She lived chiefly in London and Malvern, and was Professor of Singing at the Royal College of Music from 1883 to 1886. From the proceeds of her American tour and other engagements she founded the Mendelssohn scholarship, and also gave a hospital to Liverpool. She also interested herself greatly in the Bach Choir conducted by her husband. She was called the "Swedish Nightingale," and, from the accounts written of her voice

by those who had heard it, seems to have deserved the name.

Gold-sinny, GOLD-FINNY (*Crenilabrus melops*), a common British Wrasse of small size, living near rocks and feeding on molluscs and crustaceans. There is a dark spot behind the eye, the back is purplish, the under-surface greenish, and the sides of the head red. The pre-operculum is dentulated.

Goldsmit, OLIVER, was born on the 10th November, 1728, at Pallas or Pallasmore, in county Longford, but his father, a clergyman, soon obtained the living of Kilkenny West, and the boy was brought up in the neighbouring village of Lissoy. At seventeen he entered Trinity College, Dublin, where he led a careless life. After taking his degree, he lived at home for two years. He tried to take orders, but, for unknown reasons, was rejected by the bishop. Then he held a tutorship, and made an attempt to emigrate, after which an uncle came to the rescue, and started him to study law at the Temple with £50. This, however, he spent in Dublin, and his uncle sent him to learn medicine in Edinburgh. There he remained from 1752 till 1754, after which he spent ten months at Leyden, at the end of which, being penniless, he thought that a tour might be enjoyable. He wandered to Italy, supporting himself by playing the flute and by other mysterious means. In 1756 he reached London, where he continued his hand-to-mouth existence, as a doctor, as a corrector of the press for Richardson, and as usher in the school of Dr. Milner at Peckham. It was in this school that he stumbled on literature as a profession. A bookseller, Griffiths, dining there, was so much struck by his ability that he employed him for board and lodging and a trifle of money to write in *The Monthly Review*. For five months this arrangement lasted, after which Goldsmith set up as a literary man on his own account, but soon drifted again to Peckham, then back to literature, until Dr. Milner obtained him the promise of a medical appointment on the Coromandel Coast. This prospect, however, was not realised, and after failing to pass an examination as "hospital mate" Goldsmith returned to his books. In 1759 he published his first original work, *An Inquiry into the Present State of Polite Learning in Europe*, and eight numbers of weekly essays in *The Bee*. In 1760 he brought out in *The Public Ledger* a series of letters from an imaginary Chinaman, which were so successful that they were republished in 1762 as *The Citizen of the World*. The year 1761 was marked by his first visit from Dr. Johnson, and in 1763 he became one of the original members of "The Literary Club," where he met Reynolds, Burke, Garrick, and other notable men. His anonymous *Letters from a Nobleman to his Son* made, at this time, a great success. He had now reached his great period of production. *The Vicar of Wakefield* was sold to a publisher in 1764 and published two years afterwards. His two best-known poems, *The Traveller* and *The Deserted Village*, came out in 1764 and 1770, and his two comedies *The Good-Natured Man* and *She Stoops to Conquer*, in 1767

and 1772. Meanwhile, reckless in expenditure, and ready to give his last guinea to anyone in distress, the poor genius was sinking deeply in drudgery and debt. He wrote much for booksellers, even long histories of Rome and of England, and a compilation in eight volumes on *Animated Nature*, and earned sums which would have kept an ordinary man in comfort. Anxiety, however, darkened his closing days, and he died on the 4th April, 1774. Soon after his death his unfinished poem *Retaliation* was published. As a writer Goldsmith has a perennial charm. Original alike in poetry, fiction, and comedy, he stamped his work with the perfection of order in which his life was lacking, and with the simplicity, the sensibility, the humour and wisdom which have endeared him as much to those who have succeeded him as to his own generation.

Goldstücker, THEODOR (1821-72), a German Sanskrit scholar, was born at Königsberg. He came to England in 1850, and was from 1852 till his death Professor of Sanskrit at University College, London. He founded the Sanskrit Text Society, and wrote *Panini: His Place in Sanskrit Literature*, part of a Sanskrit dictionary, etc.

Golf is a game that, for some four centuries, was almost exclusively confined to Scotland, where it had been played at least from the reign of James II., for we find the Scots Parliament, alarmed at the decay of archery, enacting in 1457 that golf be "utterly cryt down and nocht usit." About the year 1881, however, the game sprang into universal favour throughout the British Empire. In theory the game is as simple as in practice it is difficult. Baldly stated, the object of the player is to drive a small guttapercha or rubber-cored ball from hole to hole over a given course in the fewest strokes. The course consists usually of downs or links by the sea, or of commons or parks inland. The holes are from 200 to 500 yards apart, and a full-sized course contains eighteen holes. Between the holes "bunkers," either natural or artificial, are interposed. The most frequent obstacles are ponds, streams, sandhills, pits, gorse, heather, which are to be evaded or surmounted by the player. To the account of such difficulties must be laid the quantity of objurgation that is often alleged to be audible in the vicinity of most bunkers. The hole is surrounded by a sheet of closely-cropped, well-tended turf, known as the putting-green. The players use a variety of clubs, according to the "lie" of the ball, but the following may be regarded as forming the golfer's kit, which is usually carried by a "caddie"—the driver, brassey, cleek, loftier, mashie, and putter. St. Andrews is the golfers' Mecca, the Royal and Ancient Golf Club of the venerable city being the law-giver of the game. Amongst some of the best greens may be mentioned St. Andrews, Carnoustie, Gullane, North Berwick, the Brae Hills, Prestwick, Troon, in Scotland; and in England, Sandwich, Westward Ho, Hoylake, Felixstow, Ashdown Forest, Wimbledon, Mitcham, Blackheath, and Furzedown (Tooting); while there is a sporting course at Howstrake, near Douglas, in the Isle of Man. Games are usually played one or two a side, the latter forming

a "foursome"; and women are as keen players in their way as men. On greens with gravel, chalk, or sand subsoil, golf can be played all the year round, red balls being used when the links are under snow. The rules of the game will be found in most text-books, or can be had from the "Royal and Ancient," as it is affectionately styled, of St. Andrews.

Goncourt, EDMOND DE (1822-88), and JULES (1830-70), two French novelists, whose works are, perhaps, the most successful result of collaboration ever seen. The former was born at Nancy and the latter at Paris. Before writing fiction they published a series of sketches dealing with the history of the 18th century, the chief of which were *Histoire de la Société Française pendant la Révolution* (1854) and *Portraits Intimes du XIX^e Siècle* (1856-58). In after years they also produced *La Femme au XIX^e Siècle*, and some artistic studies, *L'Art au XIX^e Siècle* (1874), and studies of Watteau and Proudhon by the elder brother only. Their first novel was *Les Hommes de Lettres* (1860); and the best of their joint productions were *Renée Manperin* (1864), *Germinie Lacerteux* (1865), and *Madame Gernaisais* (1869). Jules died on June 20, 1870, but Edmond wrote after his death *La Fille Élisa*, which had both merit and popularity, and several other works. The letters of Jules were given to the world in 1885, and the *Journal* of the brothers appeared in complete form in 1888. Their artistic was of greater value than their historical work.

Gondar, a town in the centre of Abyssinia, 30 miles north of Lake Isana. It was formerly a large town in which the Emperor resided; it was partially burnt by the Dervishes in 1889. Gold and silver filigree-work, musical instruments, and fine leather are made here; and there are forty churches.

Gondokoro, on the Upper Nile, about 150 miles north of the Albert Nyanza, is a centre of the ivory trade. It was formerly also a great resort of slave-traders, but Baker put down this traffic in 1871.

Gondola, a long narrow boat, with high, curved prow and stern, which gradually diminish in width and end in a point. The gondolier stands at the stern, and propels the boat by means of a large and very powerful kind of oar. They are a striking object on the canals at Venice.

Gonds, a large division of the Dravidian race, who give their name to the region of Gondivâna, comprising both slopes of the Vindhya Mountains in Central India. As indicated by their name (either from a Sanskrit word meaning "cave-dwellers," or else "highlanders" from the Telugu *konda*, "mountain"), the Gonds belong to the primitive population of the peninsula, and are the most numerous and widespread of all the uncivilised Indian peoples. They are distinguished by a very dark complexion—some of the tribes being almost black—with straight black hair, somewhat broad flat features, round face, and low stature, averaging little more than five feet three inches. But the type varies considerably amongst the

different tribes, of which the chief are: Badiya, Koram, Paoli, Murpasi, Siamb, Markand in the Korea Hills and Sirguja; Raj Raghawal Dadave, Katulya, Padal, Dholi, Ojhya, Thokyal, Koikopal, Kolam and Madyal in the Central Provinces; Marias, Hulbas, and Badiyas in the southern dependencies. All speak dialects of the rude uncultivated Gondi language, which has lately been reduced to writing by the missionaries. In it have appeared two of the gospels and other parts of Scripture in the Devanîgari character. The tribal affairs are regulated by a council of elders under a *thakur* or chief usually of Rajput origin. Their religion is of an extremely primitive type, and presents some curious features, such as the worship of small-pox, the cholera, fever, the tiger and other personified malevolent influences represented, not by idols, but by small blocks of stone disposed in a circle round some gigantic forest tree. These monoliths are still smeared with a red ochre to represent the blood of the animal or human victims formerly sacrificed to avert their wrath. But many are now Christians or worshippers of Siva, Vishnu, and the Hindu divinities. They cultivate a little land in a nomad sort of way, moving from place to place according as the soil gets exhausted. But their chief dependence is on wild fruits, roots, the edible flowers of the mhowa tree, and all kinds of game, which still abounds in the forests of Gondivâna. (Captain Forsyth, *The Highlands of Central India*, 1871; Charles Grant, *Gazetteer of the Central Provinces*; Rev. J. Caine on *The Kois or Gonds in Journal of the Royal Asiatic Society*, February, 1881.)

Gongora, LUIS DE GONGORA Y ARGOTE (1561-1627), a Spanish poet, was born at Cordova. He studied law at Salamanca, but eventually took orders, and became chaplain to Philip III. He wrote sonnets, lyrical poems, and guitar-songs, and in his later works was decidedly euphuistic, like the earlier Elizabethans in England. An incomplete edition was published in the year of his death, and in 1659 a complete edition appeared at Brussels. *Solidades* and *Pyramo y Thisbe* are the names of two of his longer poems.

Goniatites, the type genus of the *Goniatitidae*, a family of Cephalopoda with coiled shells resembling those of the Nautilus but in which the sutures are angulated instead of wavy. The family is extinct, and flourished most in the Carboniferous period, though it survived till the Triassic.

Gonidia, green cells leading an independent existence, being, in fact, unicellular Algae (q.v.). They are generally spherical, and have seldom a defined cellulose membrane. In addition to chlorophyll (q.v.) they sometimes contain phycocyan or other colouring matters. The term is especially applied to those algal cells belonging to various members of the sub-classes Cyanophyceæ and Chlorophyceæ, which, imprisoned by the hyphae of various fungi, constitute the symbiotic compound organism known as a lichen (q.v.).

Goniometer is an instrument chiefly used in crystallography for the measurement of solid

angles, the best known being those of Carangeau and of Dr. Wollaston.

Goniophyllum, a well-known genus of corals from the Silurian rocks. It is characterised by its well-marked quadrilateral shape; the internal structure is of the type known as "vesicular," while the septa are distinct plates or laminae, and not mere striae. [CORAL.]

Gonorrhœa, a disease characterised by inflammation of the mucous membrane of the genital passages with purulent discharge. The malady is now known to be due to a specific micro-organism, and infection is transmitted from one subject to another by direct contagion. The inflammatory mischief is accompanied by great pain in the acute stage, and chronic trouble is apt to be left behind after the force of the disease is spent—a thin watery discharge sometimes persisting for years. Matters are sometimes complicated by the superintervention of an exceedingly intractable affection of the joints known as gonorrhœal rheumatism, and among the sequelæ of the disease stricture of the urethra may be mentioned as a frequent and distressing after-trouble in the male subject. The serious nature of the malady urgently demands that the sufferer should obtain proper medical advice from the outset, and on no account should reliance be placed in any quack remedy. The discharge in the acute stage is eminently contagious, and is capable of being inoculated upon the mucous membrane of the conjunctiva. When such a mishap occurs severe inflammation is set up (gonorrhœal ophthalmia), and loss of sight is then no uncommon result.

Gonsalvo di Cordova (1453–1515), a great Spanish general, whose real name was GONZALO HERNANDEZ Y AGUILAR, was born near Cordova. He distinguished himself as a soldier in the wars with the Moors and Portuguese, and conducted with great skill the negotiation with Boabdil, King of Granada, with which the former closed. He afterwards drove the French from Italy for Ferdinand II. of Naples, and gained by his exploits the title of "the great captain." In 1500 he recaptured Zante and Cephalonia from the Turks, and three years later again commanded against the French in southern Italy. By the victory of Garigliano (December 29, 1503) he re-established the Spanish kingdom of Naples, of which he was appointed Viceroy soon afterwards. In Spain, however, his enemies intrigued with success against him, and when recalled he thought it best to retire to his estates in Granada, where he died.

Gonzaga, the name of a ducal dynasty at Mantua and Montferrat. LUIS GONZAGA ousted the Bonacossi family from the lordship of Mantua in 1328, and GIOVANNI FRANCESCO (1394–1444) was created Marquis by the Emperor Sigismund in 1433. His son LUIS, "the Turk" (1444–78), owned one of the finest bodies of mercenaries in Europe. His grandson FEDERICO (1500–40) was made Duke by Charles V., and received Montferrat from him. Several of his successors were cardinals. FERNANDO CARLO (1652–1708) was put to the ban of the

empire and deprived of his duchies for favouring the French cause in the Spanish Succession War. Two Counts and five Dukes of Guastalla also belong to a collateral branch of this family. The last of them died in 1746. Like most Italian princes, the Gonzagas were munificent patrons of literature and the arts, besides being vigorous and unscrupulous warriors.

Gonzaga, LUIGI, Marquis of Castiglione. [ST. ALOYSIUS.]

Goodall, FREDERICK, a well-known English painter, was born in London in the year 1822, his father being an engraver. He exhibited when only seventeen at the Royal Academy. In 1847 his *Village Holiday*, now in the National Gallery, was seen, and was followed in 1851 by *Raising the Maypole*. Two years later he was elected A.R.A., and in 1855 and 1856 he exhibited two historical paintings. He went to Egypt in 1857, and henceforth most of his subjects were Oriental. He became R.A. in 1863. He died in 1904.

Good Conduct Pay, extra pay allowed to soldiers in the British army below the rank of non-commissioned officers. A soldier who after two years' service has committed no crime or breach of discipline sufficiently serious to be entered in the regimental defaulters' book is entitled to 1d. a day. After 6 years' service he receives another 1d., if his name has not been entered for two consecutive years. Twelve years' service under the same conditions entitle him to a third 1d., eighteen to a fourth, and each additional 5 to another 1d. There is a badge, corresponding to each of these payments, which is worn on the left sleeve. A soldier whose name is not entered during 14 years henceforward receives his good conduct pay two years before the usual time. An entry in the regimental defaulters' book involves the loss of one badge and the pay accompanying it, but these may be recovered under certain conditions. But a soldier on whom a severe sentence is passed, whether by a court martial or a civil court, thereby forfeits all his badges and good conduct pay. The good conduct pay awarded in the navy never exceeds 3d. a day, and may be held by petty officers.

Goodenough, JAMES GRAHAM, naval officer, born about 1830, became a lieutenant in 1851, a commander in 1858, and a captain in 1863, and after greatly distinguishing himself in many ways in the fields both of war and peace was appointed commodore on the Australian station, with his broad pennant in the *Pearl*. Here he was attacked with poisoned arrows by the natives of Santa Cruz island, and, being wounded in two places, died from tetanus nine days later, on August 21st, 1875. A gold medal bearing his name is now given to the sub-lieutenant who passes the best examination of his year in January, and who has also taken a first class in seamanship.

Good Friday, the Friday before Easter, is the day on which our Lord's crucifixion is commemorated. Together with Easter Day it took the place of the Jewish Passover under the new dispensation, and was named *Pascha Stavrosimon*

(Greek, "the paschal day of the crucifixion") by the early Church, who observed it as a day of fasting and prayer. In the Roman Catholic Church none but sick persons and the priest who ministers to them are allowed to partake of the sacrament. The priests and acolytes are clothed in black, the altar remains bare as on the preceding day, and special prayers are offered up for all orders in the Church, as well as heretics, Jews, and pagans. In the Anglican Church proper psalms and special collects, including a prayer for all Jews, Turks, infidels, and heretics, are ordained for Good Friday. In England and Ireland public business is suspended in accordance with legal regulations, but this practice does not extend to Scotland or the United States.

Goodrich, SAMUEL GRISWOLD (1793-1860), an American writer, best known by his pen-name, "Peter Parley," was born at Ridgefield, Connecticut. His most popular works were children's books, of which he published a great number. Hawthorne's *Twice-Told Tales* appeared in a Boston annual edited by him. Goodrich's *Recollections of a Lifetime* appeared in 1857.

Good Templars, a temperance society established in the United States in 1852, and in England in 1868. The organisation resembles that of the Freemasons, with lodges, pass-words, etc.

Goodwill, the benefit which accrues to a business which has been carried on for some time in a particular place either by one person or by a firm, or from the use of a special trade mark or trade name. Its value is coextensive with the probability that old customers will continue to be customers notwithstanding a change in proprietors or in its place of business. An assignment of a goodwill implies a recommendation of the assignee by the assignor to his connection, and an agreement by him to abstain for the future from all competition in the business. A goodwill is considered a subject of sale along with the stock and business premises. In taking an assignment of a goodwill it is usual for the assignee to have a general covenant from the assignor not to carry on business within a certain distance from the premises.

Goodwin Sands, a famous shoal lying some five miles off the coast of Kent between Sandwich and Deal. It is 10 miles long, and from $1\frac{1}{2}$ to 3 miles in breadth. It was once an island, and formed part of the estate of Earl Godwine. From his son it was taken and given to St. Augustine's Abbey at Canterbury; and the story goes that the abbot of this house, instead of keeping the sea-wall in proper condition, spent the money which should have gone towards it on the building of Tenterden steeple. So when in 1099 the island was submerged by the waves, it was said that "Tenterden steeple was the cause of the Goodwin Sands." This tale is not, however, consistent with the facts of science. The Sands act as a breakwater to the waves of the Downs. Great part of them is sometimes dry for hours, and quite firm; but when covered by the sea they shift. Many ships have been lost on them, and elaborate precautions are

now taken to warn vessels. Four lightships, each painted red, the lights of which can be seen at a distance of 10 miles, are stationed round the shoal, and there are also nine buoys of various colours and shapes moored around. Gongs are sounded during a fog, and warning guns are fired at all times. Attempts have also been made to set up a lighthouse, but without any permanent success. Ships actually wrecked are succoured by life-boats from Ramsgate, Deal, Walmer, and Kingsdown, aided by small boats called "Hovellers' boats." Among the many catastrophes connected with the Goodwin Sands may be mentioned the following:—On the night of November 26, 1703, no less than thirteen men-of-war were lost during what is known as "the great storm," and an admiral and 1,200 men perished, only about 200 being rescued by the great exertions of the mayor of Deal. In 1805 the *Aurora* and 300 persons were submerged, and in 1814 the *British Queen*, with all hands, went under. The last great loss on these sandbanks was that of the mail-steamer *Violet* in January, 1857.

Goodwood, the seat of the Duke of Richmond, 3 miles N.E. of Chichester, Sussex, is notable for its collection of portraits and its famous park. A mile to the N.E. of the house is Goodwood race-course, where horse-races have taken place in every July since 1802.

Goodyear, CHARLES (1800-60), the inventor of vulcanised indiarubber, was born at New Haven, Connecticut, and died in New York. He began life as an iron-manufacturer, but about 1834 began to devote his attention to the making of indiarubber. He took out his first patent in 1844, and after a long struggle and much litigation succeeded in further perfecting his invention. He took out in all 60 patents, and his material was applied to nearly 500 different uses.

Googe, BARNABE (1540-94), an Elizabethan poet, was a native of Lincolnshire. He was a protégé of Cecil, Lord Burghley, through whose influence he obtained an office at Court and employment in Ireland. His *Eglogs, Epytaphes, and Sonnetes* were published in 1563; they are included in Arber's *English Reprints*. He was much esteemed by his contemporaries.

Goosander (*Mergus merganser*), a bird of the Duck family from Arctic and North Temperate regions, visiting Britain in the winter, some few breeding in Highland lochs. The adult male is a little over two feet long; the head and upper part of the neck are deep glossy green, forming a crest-like tuft at the crown; the back is black, fading into grey; the wings are black mixed with white, and the under is a warm buff. The female is a little smaller, with duller plumage. These birds live on fish, which they take by diving and hold easily in the serrated bill, the teeth-like edges of which have given rise in some parts of the country to the popular name of Saw-bills for these birds. [MERGANSER.]

Goose, any bird of the genus *Anser*, of the Duck family (*Anatidae*), ranging over the Palaearctic and Nearctic regions to Central America and the

Antilles. The body is compact, and the legs are set nearly in the centre, so that these birds can walk fairly well on land; the neck is short, and the head large; the upper mandible is vaulted and terminated by a broad nail, and the lower mandible is flat beneath. The plates at the margins of the bill are modified into tooth-like processes, well adapted for cropping the vegetation which forms the principal food of these birds. There are three toes in front, all united by a membrane; the hinder toe is free. On the wrist joint (that is, at the bend of the wing) is a hard knob, which in the Spur-winged Goose (*Plectropterus gambensis*), from Central and South Africa, is developed into spur. Geese are far less aquatic than ducks, and though they swim well they rarely dive, and great part of their life is spent on dry land. The Common Goose was domesticated at a very early period, and has run into many varieties, of which the Toulouse Geese are the largest. The plumage of the adult bird is white; newly-hatched goslings are covered with greyish down, and the young birds retain some dark patches. Economically the goose is of great importance for the table, for its soft feathers, and, to a less degree than formerly, for its quills, which are still made into pens, and which, like the feathers, are plucked from the living birds. Large herds of geese are kept in Lincolnshire, Norfolk, and Suffolk to supply the London markets. The famous Strasburg *pâté*s are made from goose-livers abnormally enlarged by keeping the birds without water in a place where the temperature is very high. Four species of wild geese are British visitors, but of these only one—the Grey Lag Goose (*A. cinereus*)—stays to breed, though it was common in the Fen country before that district was drained. This bird, from which the domestic goose is probably derived, is about 35 inches long, greyish-brown above, and white with dark markings beneath; the female is smaller. The Laughing or White-fronted Goose (*A. albifrons*), with brown plumage, is much smaller. In these two species the nail at the end of the bill is white, while in the other two—the Bean Goose (*A. segetum*) and the Pink-footed Goose (*A. brachyrhynchos*)—it is black. [BARNACLE GOOSE, BRENT GOOSE, CEREOPSIS, DUCK, SWAN.]

Gooseberry (*Ribes grossularia*), a well-known fruit-bearing shrub, native to Nepaul, Western Asia, North Africa, the mountains of Crete, Central and Northern Europe, as far north as lat. 63°, in Norway, and in the North of England. The name "gooseberry" and the French *groseille* are probably derived from the German *krausbeere*, whilst the provincial name, "feaberry," indicates the value formerly attached to its cool acid fruit in cases of fever. The plant differs from the allied species of *Ribes*, the currants, in its spinous stems and in its flowers being produced singly or two or three together, and not in a raceme. It has long been cultivated, and many hundred sorts have been raised, with fruit either hairy, downy, or smooth (*var. Uva-crispa*), round or oval, green, yellow, or red. The acidity of the green fruit is due mainly to malic acid. It is largely used for tarts. When ripe the fruit contains from 6 to 8 per cent. of sugar,

and is used for dessert and jam. The shrub suffers much from attacks of insects, especially the larvae of the beautiful magpie moth (*Abracæs grossulariata*) and that of the V-moth (*Halias vanaria*).

Goose-fish, a local American name for the Angler (q.v.).

Goosefoot, the popular name for the wild species of the genus *Chenopodium*, weedy plants with generally triangular leaves, sometimes mealy, minute flowers with five perianth-leaves, five stamens, and two styles; and a single seed with copious floury albumen, in a one-chambered ovary. The genus, which comprises about fifty widely-distributed species, is the type of the cephalous order *Chenopodiaceæ*.

Gooseneck, a name applied in the metallurgy of iron to the pipe conveying the *blast* from the main pipe to the tuyers by which it is delivered into the blast furnace, where the iron is being smelted.

Gopher, a loose name for several American burrowing animals, among others the prairie-dog, the chipmunk, and *Testudo carolina*, a tortoise from the southern states.

Gorakhpur, a district and city in the North-West Provinces of British India. The former has an area of 4,578 square miles, being bounded N. by Nepaul, S. by the river Gogra, E. by Champaran and Saran, and W. by Fyzabad and Bari. It consists for the most part of a wide alluvial plain stretching up to the feet of the Himalayas, and broken by a few sandhills and many dense forests. Rivers, lakes and marshes abound, among the former being the Rapti, the Gogra, both Gandaks, the Kuana, and others. The population, chiefly Hindu, shows a tendency to increase. Cotton, timber, rice, and other grains form the chief produce. Gautama Buddha, the founder of the Buddhist cult, died in this region, which thus became the cradle of the new faith. The British occupation dates from 1801. The city of Gorakhpur was founded about 1400 on the Rapti, and is the administrative centre of the district, possessing a considerable trade in timber and food-stuffs.

Gorales, Polish communities of the Berkid Mountains (Western Carpathians), Galicia, who, despite the almost troglodyte existence which they lead in these remote uplands, have the reputation of being physically the finest, and morally the most intelligent, of all the Galician populations. Like their Slovak neighbours, they leave their villages periodically in search of employment in Poland, Germany, and Hungary, never failing to return with their earnings to their mountain homes. They also act as guides to wayfarers across their almost trackless forests, and are much addicted to the contraband trade carried on across the political frontiers. The national name means "Highlanders," from the Slavonic word *gora*, a mountain.

Gorchâni, one of the main branches of the Baloch nation, chiefly in the Jampûr division of the Dera Ghazi Khan district on the Afghân frontier. There are a large number of septs grouped under

twelve or thirteen separate divisions, of which the most important are the Shikâni, Hotwâni, Khalilâni, Jaskâni, Pitafi, Lishâri, and Durkâni, comprising altogether 2,600 fighting men, and 23,000 souls. The Gorchâni are not of pure Baloch stock, and are even regarded by some ethnologists as of Jât origin. Their historic traditions go back to the eighth century, when they were settled in Sindh, and after their enforced conversion to Islâm removed by the Arab conquerors to the northern parts of Saravân. In the eighteenth century they migrated towards the Indus, where they wrested their present territory from the Afghâns. With the British conquest of Punjâb they passed under English rule, and are at present chiefly grouped round the frontier fortress of Harrand in the upland valleys of the Soleimân Range. (Macgregor, *Gazetteer*; Bruce, Major Minchin.)

Gordiacea, a division of the Nematode worms which have been ranked by Vejdovsky as a distinct class, the "Nematomorpha," as they differ greatly from the normal Nematode in their nervous, digestive, and generative systems. [NEMATODA.]

Gordian Knot. Gordius was a Phrygian peasant, who became king of the Phrygians in consequence of a response of the Delphic oracle, telling them to choose the first man whom they saw riding in a cart to the temple of Zeus. After his election Gordius consecrated his cart and yoke to Zeus, and placed them in the citadel of Gordium, a name given in honour of himself. The yoke was tied with a knot so intricate that an oracle announced that he who unloosed it would become ruler over Asia. The prophecy was fulfilled by Alexander the Great, who severed it with his sword.

Gordianus, or **GORDIAN**, a name borne by three Roman emperors. MARCUS ANTONIUS AFRICANUS GORDIANUS assumed the purple in 238 jointly with his son, being at that time pro-consul in Africa. They were, however, speedily overthrown by Capelianus, who represented the deposed Emperor Maximin in Mauretania. The Senate then called Maximus and Balbinus to share the throne, and with them MARCUS ANTONIUS GORDIANUS PIUS, a mere boy, was associated in the imperial dignity. His two colleagues being killed in a revolt of the Praetorian Guards, the young Gordianus reigned alone, under the tutelage of his father-in-law, Misitheus. On the death of the latter, probably through poison administered by his rival Philip, the emperor then marching to quell an insurrection in Persia was murdered by his soldiers (244 A.D.) on the banks of the Euphrates.

Gordon, ALEXANDER, the author of the *Itinerarium Septentrionale* and immortalised as "Sandy Gordon" in Scott's *Antiquary*, was probably born and educated at Aberdeen about 1700. Little is known of his early life, but he seems to have travelled as a tutor, and in 1726 he reappeared in Scotland and published his great work. He held successively the secretaryship of the Society for the Encouragement of Learning, the Society of Antiquaries, and the Egyptian Club. In 1741 he

settled in South Carolina, and became registrar of the province. The date of his death is uncertain, but his will was made in 1754.

Gordon, CHARLES GEORGE, GENERAL, was born in 1833, and received a commission in the Royal Engineers at the age of nineteen. In 1855 he was sent out to the Crimea, and took part in the siege of Kinburn and the destruction of Sebastopol. He joined in 1860 the allied forces in China, being present at the capture of Pekin and aiding in the building of the Taku forts. The outbreak of the Tai-ping insurrection afforded him an opportunity for distinguishing himself by suppressing the rebels in the Shanghai district, and he was appointed to the command of the disorganised Chinese army, and in little more than a year the revolt was crushed. In 1874, at the invitation of the Khedive, he undertook the control of the Soudan with a view to the extirpation of the slave-trade. He resigned in 1876, but was reinstated in 1877 with fuller powers as Governor of the Soudan and the Equatorial Provinces. In 1884 he was entrusted with the dangerous and difficult duty of the pacification of the Soudan, a task for which he felt himself to be specially qualified. Too confident, perhaps, in the prestige of his name, he hurried on single-handed to Khartoum, the stronghold of Mahdism. There he maintained himself amidst a wretched and untrustworthy garrison against a siege of 337 days. A relief expedition was sent out with Lord Wolseley in command, but on January 26, 1885, a few days before the advanced guard of the British force were in sight, Khartoum fell into the hands of the fanatics, and Gordon, who scorned to save himself by flight, was killed among the foremost.

Gordon, LORD GEORGE, third son of the Duke of Gordon, was born in London in 1751. He left Eton to enter the navy, but soon resigned his commission and was returned to Parliament for Luggershall in 1774. A fluent speaker and a man of eccentric but honest views, he attached himself to no party, until his violent opposition to the removal of Roman Catholic disabilities placed him, in 1780, at the head of the turbulent Anti-Papal leagues. In this capacity he led a mob to Westminster for the purpose of presenting a monster petition against the Toleration Act, and the riots ensued with which his name is associated. Many Catholic chapels, private houses, and prisons were broken into and set on fire, the Bank of England was attacked, and 450 lives were lost before quiet could be restored. He was arrested and brought to trial, but escaped conviction owing to the skilful management of his defence by Erskine. In 1787 he was convicted of libels against the Queen of France and other persons, but he fled to Holland. Returning in 1788, he was sentenced to five years' imprisonment, and died in Newgate a few months after the expiration of that period, as he refused to give securities for good behaviour on his release. Before his death he embraced Judaism.

Gordon, SIR JOHN WATSON, P.R.S.A., whose family name was Watson, was born in Edinburgh in 1788, and destined for the Royal Engineers.

His first picture, inspired by *The Lay of the Last Minstrel*, was exhibited in 1808, but he soon abandoned genre-painting for portraiture. On the death of Raeburn in 1823 he succeeded to his practice, and assumed the name of Gordon. Among his most distinguished sitters may be mentioned Sir Walter Scott, Sir Archibald Alison, Dr. Chalmers, J. G. Lockhart, Professor Wilson, De Quincey, Sir David Brewster, Lord Dalhousie, Lord Macaulay, Lord Cockburn, Sir John Shaw-Lefevre, and the Prince of Wales. Though monotonous as a colourist, he threw much dignity and character into his portraits. He received the distinction of knighthood and the appointment of Limner to Queen Victoria in 1850, and was elected a Royal Academician in the following year, dying in 1864.

Gordon, LUCIE, LADY DUFF, the only child of John Austin, the jurist, and of his gifted wife, was born in 1821. As a child she accompanied her parents abroad, and thus became a finished French and German scholar, and a friend of Heine. At the age of eighteen she published a translation of Niebuhr's *Greek Legends*, and in 1840 married Sir Alexander Duff Gordon. Inheriting her father's delicate constitution, she was obliged to take a sea voyage, which led to the publication in 1862-64 of her charming *Letters from the Cape*. Still more delightful are her *Letters from Egypt*, which appeared in 1865. She died at Cairo in 1869. Among her other works, chiefly translations, are *The Amber Witch*, *The French in Algiers*, *The House of Brandenburg*, *Remarkable Criminal Trials*, and *Sketches of German Life*, in the last of which her husband took a share.

Gordon, GENERAL PATRICK, born in Aberdeen-shire in 1635 and connected with the Earls of Aberdeen, was sent to Prussia to complete his education. Having run away from college, he enlisted in the Swedish service, and from 1655 to 1661 fought alternately on the side of the Swedes and their enemies the Poles. He then joined the Russian army, and in 1666 was sent by the Tsar Alexis on a mission to England. He rose rapidly through his zeal and abilities displayed in campaigns against Turks and Tartars, and was promoted by Peter the Great to the command of the forces by which the Tsarina Sophia was defeated, and ultimately to the command-in-chief of the empire. He died in 1699, leaving an interesting diary, portions of which have been recently published.

Gore, MRS. CATHERINE GRACE, the daughter of Mr. Moody, was born at East Retford, Notts, in 1799, and in 1823 married Captain Charles Gore. Her first novel, *Teresa Marchmont*, appeared in that year, and before 1832 she had published *The Reign of Terror*, *The Lettre de Cachet*, *Hungarian Tales*, *Manners of the Day*, *Mother and Daughter*, and *The Fair of Mayfair*. Then there was an interval of non-production during which she travelled, her next venture being *Mrs. Armitage* in 1839. *Cecil; or the Adventures of a Coccomb*, *Greville*, *Fascination*, and *The Banker's Wife* are the best-known amongst the many clever but superficial

sketches of society which she continued to throw off until her death in 1861.

Gore, SIR JOHN, British naval officer, was born at Kilkenny in 1772, entered the navy in 1780, and served in the attempted relief of Cornwallis at Yorktown, and in Rodney's actions in 1782. In 1794 he distinguished himself ashore at Toulon, and subsequently in Corsica, where he was under Nelson's orders. In that year he was posted, and in 1795, having taken part in her capture, was appointed to the *Censeur*, 74. In her he was taken by a squadron under Admiral Richéry, after a most brilliant defence. He was soon exchanged, and was afterwards employed in the *Medusa*, Nelson's flag-ship, in the operations against the Invasion Flotilla. Later he assisted in the capture of three valuable Spanish treasure-ships, and for this exploit he was knighted. He served almost continuously, and was many times in action, until his promotion to flag-rank in 1814, whereupon he assumed command in the Adriatic and the Levant, and took possession of Corfu. He was commander-in-chief in the Medway from 1818 to 1821, and, after doing other services, died a vice-admiral in 1836.

Görgei, or Goergey, ARTHUR, a Hungarian general, who was born at Toporez in 1818, and entered the cavalry at the age of 18, but retired in 1845 to devote himself to study and the management of his estates. The revolutionary movement of 1848 caused him to resume the sword, and he was entrusted by the Hungarian Government with an important command. Count Eugene Zichy was tried and executed by his orders for treason. He forced Roth to a capitulation, and, though defeated at Schwechat, was appointed by Kossuth to the chief command. In 1849 he declared himself against separation from Austria, and was for a time superseded by Dembinski. Being restored to power he achieved considerable successes at Nagysarло, Komorn and Buda, but was forced to retreat by Haynau. In August, 1849, he was appointed dictator, and, finding his position desperate in face of the Russian army and the intrigues of Kossuth's party, he surrendered at Világos, received a pardon, and retired to Klagenfurt, where he wrote an elaborate defence of his conduct (1852), and was subsequently employed as a railway engineer.

Gorgias, a Greek philosopher, one of the early "Sophists" or teachers of rhetoric, was born at Leontini in Sicily early in the 5th century B.C., and died at Larissa in Thessaly about 375 B.C. Little is known of him save that Plato associated his name with one of the most finished of his dialogues, and that he was the author of a work *On the Non-existent, or Nature*.

Gorgon, or **GORG**, a mythical conception of the early Greeks, in which may perhaps be traced an impersonation of the thunderstorm. According to Hesiod there were three Gorgons, but Medusa is the only one of importance. From her Poseidon begot Chrysaor and Pegasus (lightning and thunder?) who sprang out of the monster's blood, when Perseus, the light-bearing hero, cut off her head

and placed it on Athene's shield to turn to stone all who gazed on it. The hideous mask was gradually transformed by art into a beautiful though awesome face of death. Attic legends connect the idea with the war between Zeus and the Titans.

Gorgonia is the best-known genus of the Axifera (q.v.), a group of the Alcyonaria (q.v.), or corals, with an eight-rayed symmetry. Its most familiar ally is *Cirrallium*, the "red coral" of commerce, from which it mainly differs by the facts that the corallium is formed from the external layer or ectoderm by means of an ingrowth (invagination) around the base; in *Coralium* the skeleton is formed by the "mesogloea" (q.v.) or the middle layer of tissues. The colony is fixed and branched. There is no "polymorphism" (q.v.), all the individual polypites being built on the same plan. In addition to the central axial skeleton, there are numerous spicules scattered through the external tissues. They are all marine. Spicules referred to the allied genus *Gorgonella* have been described from the Miocene, while some, probably belonging to *Gorgonia*, occur in Tertiary rocks in Trinidad.

Gorham, GEORGE CORNELIUS, was born in 1787, and graduated at Queen's College, Cambridge, where he became fellow and tutor. He wrote in early life several tractates on *Public Worship*, on the impropriety of mixing the apocryphal books with the canonical Scriptures, etc., and in 1848 he was presented to the living of Brampton-Speke, Devon. The Bishop of Exeter (Dr. Phillpotts) refused to institute him on the ground that he denied the doctrine of baptismal regeneration. Mr. Gorham appealed to the Privy Council, and a decision was given to the effect that his views did not justify exclusion from his benefice. The bishop declined to obey, and after two further suits Mr. Gorham was instituted by the Archbishop of Canterbury. He died in 1857.

Gorilla (*Anthropopithecus gorilla*), the largest of the Anthropoid apes, of the same genus as the Chimpanzee (q.v.). It is a native of Western Equatorial Africa, and, though mentioned by Hanno the Carthaginian (B.C. 470), only became known to science in 1847, when a skull was sent to Boston by an American missionary on the Gaboon river. Some years later Du Chaillu visited Western Africa (1855-59), and from him the first trustworthy accounts of the animal were obtained. Gorillas go about in families, and, though good climbers, live principally on the ground and travel on all fours, rarely assuming an erect posture. They subsist chiefly on fruit, occasionally taking eggs, birds, and probably small mammals. An adult male when erect is about 5 ft. 6 in. high, the skin is black and covered with long hair, very thick on the back, and varying in colour from dusky red to dull black. The skull is figured under ANTHROPOID APES (q.v.), and should be compared, especially as to the development of the canines and its bony crests, with that of man (Fig. 1). The brain is of a low type and much less convoluted than that of the orang or the chimpanzee. The ferocity of the

gorilla has probably been exaggerated, but its great strength renders it, if attacked, a formidable antagonist.

Görlitz, the capital of a circle in the district of Liegnitz, Prussian Silesia, stands on the left bank of the Neisse, 55 miles from Dresden on the railway to Breslau. It existed as the village of Drebau until 1131, when it was burned down and rebuilt under its present name. As a strong fortress it played a considerable part in history, suffered much during the Thirty Years' and the Seven Years' Wars, and was the scene of a famous battle in 1757 between the Austrians and Prussians. More recently it has become a great commercial centre, and the population has increased six-fold in sixty years. The city is well-built and handsome, with two good fifteenth-century churches, fine modern buildings, including a school of commerce, a public park, and pleasant promenades. Cloth is the staple manufacture, but railway waggon and machinery, chemicals, linen fabrics, and leather are also produced.

Görres, JOSEPH JOHANN, was born at Coblenz in 1776 of a Catholic family. As a boy he picked up the revolutionary ideas then current, and he gave expression to them in a journal entitled *Rübezahl*. Taking up strongly the grievances of his fellow-countrymen under French rule in the Rhine Provinces, he went in 1799 on a deputation to Napoleon. In 1814 he brought out the *Rheinischer Merkur*, which soon became the organ of German unity, and received the support of Stein, Varnhagen von Ense, the Grimms, Gentz, and other politicians. His Liberalism and his anti-Prussian feeling led to the suppression of the publication in 1816, and to his own expulsion from his educational office. He then became a violent partisan writer, and his pamphlet *Deutschland und die Revolution* provoked such animosity that he had to escape into Switzerland. Ultramontanism was his next phase, and he thus won the protection of Ludwig of Bavaria, who invited him to Munich. Here he produced *Athanasius*, a powerful assertion of the supremacy of the Church, and he edited a journal supporting clericalism. His death took place in 1848.

Gorse. [FURZE.]

Gortschakoff, PETER, born 1790, served in the campaigns of 1812-13-14, suppressed an insurrection in the Caucasus (1820), took part in the Turkish War of 1828-29, and from 1839 to 1852 was engaged in the administration of Eastern Siberia, where he effected great reforms. He offered his services, though broken in health, at the outbreak of the Crimean War, took command of the 6th Army Corps, and led the left wing both at Alma and Inkermann. Retiring finally in 1855, he died at Moscow in 1868. **GORTSCHAKOFF**, MICHAEL, born in 1792, passed through the same military experiences in early life as his brother. In 1830 he was sent into Poland as general of artillery, received a wound at Grochow, assisted in the capture of Warsaw, and ultimately became military governor of the province (1846). He was employed in suppressing the Hungarian patriots in 1849, and in 1852 came to London

on the occasion of Wellington's funeral. In 1853, on the resumption of hostilities between Russia and Turkey, he entered the Principalities as commander-in-chief, and proceeded to besiege Silistria. Next year he assumed the direction of affairs in the Crimea in place of Prince Mentschikoff, and displayed much skill in the defence of Sebastopol. In 1856 he returned to Warsaw, and died there in 1861. GORTSCHAKOFF, ALEXANDER, the younger brother, was born in 1800, and entered the diplomatic service whilst very young. At the age of 24 he was secretary of the Russian Legation in London. He was next transferred to Florence, and thence went to Vienna. At Württemberg he negotiated the marriage between the late king and the Grand Duchess Olga. The year 1850 found him representing Russia at the German Diet, and in 1854, as ambassador extraordinary, he undertook at Vienna the negotiations for peace, returning to take the portfolio of Foreign Affairs. For twelve years Gortschakoff held a position in European politics scarcely inferior to that which Bismarck was destined to fill, but as internal troubles forced themselves more and more on the attention of the Tsar the influence of the diplomatist declined. In 1882 he resigned, and he died at Baden-Baden in the following spring.

GÖRZ, a district occupying an area of about 1,116 square miles at the head of the Adriatic between Carinthia to the N., Trieste to the S.E., and Italy to the W., and forming with Gradiška one of the Austrian crown-lands. Limestone rocks violently distorted, subterranean rivers, amongst them being the classical Timavus, and vast forests are the chief physical characteristics of this rugged tract. The vine grows well in the stony soil, and wheat, maize, potatoes, and silk are produced in the alluvial valleys. During the dark ages Görz was an independent principality or county under the Empire, but in 1500 it lapsed to the House of Hapsburg. The population is mainly Slovenian and Catholic.

GOSCHEN, THE RIGHT HON. GEORGE JOACHIM, VISCOUNT, was born in 1831. He passed from Rugby to Oriel College, Oxford, where he took a first class in classics in 1858. In 1863 he was returned as a Liberal for the City of London, and gave strong support to the movement for abolishing religious tests in the universities. In 1865 he joined Lord John Russell's Ministry as Vice-President of the Board of Education, being transferred next year to the Chancellorship of the Duchy of Lancaster with a seat in the Cabinet. In 1868 he returned to power with Mr. Gladstone, holding office until 1874 first as President of the Poor Law Board, next as First Lord of the Admiralty. He proceeded to Egypt in 1876 as representative of the British bondholders, and assisted in drawing up the agreement for reorganising the finances of that country. This mission was followed up by a visit to Constantinople in 1880, under Mr. Gladstone's auspices, as Ambassador Extraordinary, and he obtained from Turkey partial recognition of the claims of Greece under the Berlin Treaty. Meanwhile he had resigned his seat for the City of London, and had been elected M.P. for Ripon. He now began to

show marked dislike to the tendencies of his party. His vote was given against Mr. Gladstone's Egyptian policy, and he joined in opposing the extension of the franchise in 1884. He was returned in 1885 for East Edinburgh against a Liberal candidate, but in 1886 he lost his seat, and found a more congenial constituency in St. George's, Hanover Square. Before the year was over he accepted the Chancellorship of the Exchequer in Lord Salisbury's Ministry. His measure for reducing the interest on the National Debt was ably worked out and skilfully carried through. In 1890 Mr. Goschen was chosen Lord Rector of the University of Edinburgh. In 1895 he became First Lord of the Admiralty in Lord Salisbury's Ministry. In 1900 he resigned and was raised to the peerage. In 1903 he was elected Chancellor of Oxford University. He died in 1907.

Goshawk (*Astur*), a genus of Falconidae, with 30 species universally distributed, except in some parts of South America, and differing from the true Falcons by having the bill without a notch. The Common Goshawk (*A. palumbinus*), formerly bred in Britain, but is now a rare visitor. The female, about two feet in length, is a little larger than her mate, and was used in falconry (q.v.), and in Asia goshawks are still employed to kill ground game. The plumage in both sexes is slaty blue above, with dark bars on the wings and tail; the under-surface is whitish with dark cross-bars.

Goshen, or THE LAND OF GOSHEN, the district occupied by the Israelites during their sojourn in Egypt, was probably situated in the most eastern part of Lower Egypt, and the classical Phacusa (Pa-Kesem) has been identified as its capital. Gesem is the form in which the word occurs in the Septuagint. Fakoos (Phacusa) still is a pastoral country 20 miles S. of Lake Sān, near which was the site of Tanis-Rameses, the ancient administrative centre and the point from which the Exodus probably started. (See Gen. xlvi. 11.) Another "Land of Goshen" existed in S. Palestine.

Goslar, an ancient walled town founded by Henry the Fowler (920 A.D.) on the river Gose at the foot of the Harz Mountains in Hanover, about 24 miles S.E. of Hildesheim. It owes its origin and prosperity to the neighbouring mines of sulphur, copper, silver, etc. There are many interesting old buildings, including a chapel of Henry III.'s cathedral (1040) with an altar supposed to be that of the idol Krodo, the Kaiserwerth, the Kaiserhaus, the monastery of Neuwerk, and the house in which Maurice of Saxony was born. It became part of Prussia in 1866.

Gospels. The word *gospel* is the Anglo-Saxon *godspell*, the "story of (the life of) God" (i.e. Christ), or "good-spell," the equivalent of the Greek *euangellion*. The four Gospels were written during the latter half of the 1st century—those of Matthew, Mark, and Luke before the destruction of Jerusalem, and that of John towards the end of the century. A comparison of the four Gospels exhibits a broad difference between that of St. John and the three others. Matthew, Mark, and Luke give full accounts of our Lord's visits to Galilee, and as the

view of His life presented by the three narratives is essentially the same, while the details recorded are sometimes different, they have been termed the *Synoptic* Gospels. If we did not possess the fourth Gospel we should not know that He kept the great festivals at Jerusalem. St. John, on the other hand, passes rapidly over His life in Galilee, recording only two incidents in His ministry there which are found in the other Gospels, but gives a full account of His teaching at Jerusalem. The reason probably is that, coming after the other evangelists, he thought it unnecessary to repeat what was already well known, especially as his book seems to have had a doctrinal rather than an historical aim. The general similarity of the Synoptic Gospels is very striking. The very words used are often either exactly or very nearly the same. This occurs most frequently when the words of another are reported, but in some of the most important narrative passages—as, for example, in that describing the Transfiguration—the verbal coincidence is very remarkable. To explain this agreement in form and matter, various suppositions have been put forward, which impugn the authenticity of all or most of the narratives. Grotius, Mill, and others suggested that the first evangelist had been copied by the second, and both the first and the second by the third, and tried to find out which was the original Gospel. The notion of Eichhorn that they were all based on a certain common document does not at first sight seem so absurd; but in order to demonstrate his theory he found it necessary to assume four copies of this document, each of which was used by one or more of the evangelists. Bishop Marsh found that Eichhorn's theory could be maintained only by raising the number of documents to eight. There is no shadow of evidence that any such documents ever existed, and, assuming their existence, it is very remarkable they should all have disappeared. A more reasonable explanation has been put forward by Giessler and others. It is pointed out that as, in the course of their missionary labours, the apostles and the teachers appointed by them would often be called upon to repeat the same historical facts, a fixed form of narrative would gradually grow up, which would sooner or later be transmitted to writing. This would apply especially to the leading events in our Lord's life, such as the baptism and the crucifixion, with the events immediately preceding it, and it is just here that the verbal agreement is the most remarkable. The accounts of the resurrection, on the other hand, differ considerably both in their wording and in the details mentioned—a fact which may be explained by supposing that, as its truth was denied by the Jews (Matthew xxviii. 13-15), each evangelist would feel himself urged to bring forward new evidence in its support.

The theories of modern German critics concerning the composition of the Gospels are too numerous and conflicting to be dealt with in detail here. Many of them put the Gospels much later than the writers whose names they bear, and regard them as coloured by the views of one or other of the two schools—the Judaisers and the Pauline school—distinguished in Acts xv. and Galatians ii.

Of the fourth Gospel in particular the genuineness has been much attacked by Baur and the Tübingen school. But a reaction from the extremes of this school, especially in the last point, has been visible of late years.

The earliest versions of the Gospels now known to us are in Hellenistic Greek—*i.e.* a somewhat debased form of Greek spoken by the Eastern nations who had come under the influence of Greek civilisation. In the case of Mark, Luke, and John there can be no doubt that this was the original form, but it is stated by Papias, Irenæus, and other Fathers that St. Matthew's Gospel was first written in Hebrew—*i.e.* in Aramaic, the dialect then spoken by the Jews. As Matthew's Gospel was primarily addressed to the Jews, so those of Mark and Luke were intended in the first instance for the Gentiles. An ancient tradition of the Church asserts that St. Mark's Gospel was written under the direction or influence of St. Peter, and this account is borne out by internal evidence.

Gosport, said to have received its name, "God's Port," from the Bishop of Blois, who found refuge here from a storm in 1158, is a fortified port on the W. side of Portsmouth harbour. The works, recently renewed, extend from the Solent to the head of the harbour, and enclose barrack accommodation for at least 5,000 men, powder magazines, the Haslar Naval Hospital, the Clarence Victualling Yard, and other establishments. There are also private sheds for building yachts, and a considerable coasting trade exists. A floating bridge connects the town with Portsmouth about a mile distant. Pop. (1901), 28,879.

Gossamer, a thin film, consisting of innumerable threads, which covers the ground or floats in the air on fine days towards the end of autumn. The separate threads are so slight that they are visible only when they catch the sunlight. Gossamer, when it is bathed in sunshine, has a beautiful sheeny effect, which is enhanced by the sparkling beads of dew that become caught in the tissue. The origin of gossamer long remained obscure. In the 17th century Dr. Hulse and Dr. Martin Lister announced that they had discovered it to be the work of spiders, but this theory did not obtain general recognition till a much later period. It is now known that it is produced by small spiders, which probably belong to several different species. No satisfactory explanation has hitherto been given as to the purpose which gossamer is meant to serve. As the spiders which produce the floating gossamer are wafted upwards with it as soon as it is formed, it has been thought by some that their object in producing it is to catch their prey in the air.

Gosse, PHILIP HENRY (1810-1888), English naturalist, began life in commerce and visited Newfoundland, Canada, and the United States. His early fondness for science was strengthened by this experience, and in 1840 he published his *Canadian Naturalist*. In 1847 he wrote *The Birds of Jamaica*, followed by *A Naturalist's Sojourn in Jamaica*. He next settled in Devonshire, and devoted himself to marine zoology, which his books

on aquaria did much to popularise. In 1850 he was elected F.R.S. Among his better known works are *Manual of Marine Zoology*, *Romance of Natural History*, *A Naturalist's Rambles on the Devonshire Coast*, *History of British Sea Anemones and Corals*. His son, Edmund Gosse, is known as a poet, translator, and critic.

Got, FRANÇOIS JULES EDMOND, was born in 1822, and, after receiving an excellent education, began his dramatic training at the Conservatoire in 1842, making his *début* at the Théâtre Français in 1844. Six years later he was elected a member of that corporation. He acted as professor at the Conservatoire and as lecturer at the École Normale, and in 1881 he received the Cross of the Legion of Honour, being the first member of his profession to attain that distinction. He died in 1901.

Gotha, formerly the capital of an old German duchy of the same name, but now the chief town of Saxe-Coburg-Gotha in the north, as Coburg is in the south, stands on a canal of the river Leina, six miles north of the great Thuringian forest. In Charlemagne's time it was a village, but under the Landgraves of Thuringia grew into a town under the walls of the strong castle of Gummestein. Passing into the hands of the Electors of Saxony in the Ernestine line, it became merged, on the death of Duke Ernest the Pious, in the duchy of Coburg. Among the public buildings are the Margaret and the Kloster churches, two smaller ducal residences, the legislative chambers, the gymnasium, the observatory, and a school occupying the former abode of Lucas Cranach. A large trade is carried on, but the most famous local industries are sausage-making and publishing, the famous firm of Perthes and Co. taking lead in the latter.

Gotham, TALES OF THE MEN OF, a collection of funny stories in which the inhabitants of Gotham, a village near Nottingham, are held up to ridicule on account of their foolish actions and remarks. The "fools of Gotham" are mentioned in the Towneley miracle plays, written in or before the reign of Henry VI., so that the tales must have existed in some form at that period. The first printed edition, entitled *Merrie Tales of the Mad Men of Gotham, Gathered Together by A.B. of Phisike Doctour*, was published about 1550. It has been conjectured that A.B. is Andrew Boorde, a popular wit, who may or may not have been the real compiler. The Gothamite tales relate how the villagers tried to hedge in a cuckoo so as to make it "sing" during the whole year, and to drown an eel which had devoured the fish in their pond, besides many other equally notable feats. One of the stories—that of the man who, whilst riding, shifted a sack of meal from his horse's back on to his own shoulders, to make things easier for the animal—occurs in a Latin poem of the 12th century, where a native of Norfolk, instead of a Gothamite, appears as the hero. In fact, it is a characteristic of the popular tales of all countries and periods to attribute exceptional folly to the inhabitants of some particular district. To go no farther than

England, we find the people of Austwick in Yorkshire and those in the neighbourhood of Marlborough Downs in Wiltshire occupying this unenviable position. The close resemblance of such tales in different lands has led some to believe that they must have been transmitted from one to another. Others attribute the similarity to the innate propensities of human nature. The question can hardly be settled till the science of folk-lore has been established on firmer grounds.

Gothenburg, the capital of the "circle" or "lau" of the same name in the south of Sweden, is situated on the Gotha river near its mouth, and is connected with Stockholm by railway and canal. It is the first commercial city in the kingdom, and with its suburbs covers an area of five and a half square miles. The harbour, accommodating vessels of moderate tonnage, is defended by three forts. The export trade consists principally of timber, iron, and grain, the chief imports being cotton, wool, sugar, coffee, etc. On the same level with the harbour stands the business town, intersected by canals, whilst the residences of the citizens are built in picturesque sites on the rocks above. There are many Lutheran churches, the Domkirka or cathedral dating from 1633, but rebuilt. The Town hall, the Kronhus, and the house of Torstenson are interesting structures. An exchange, a museum, several excellent schools, a theatre, horticultural gardens, and a King's Park add to the attractions of the town, which, besides a large carrying trade, supports various industries such as ship-building, match-making, weaving, brewing, and the manufacture of wooden furniture.

Gothenburg System, THE, denotes the peculiar mode of regulating the traffic in alcoholic drinks which was adopted in the above town in 1865. The sole licensee is a limited company, which pays over to the municipal authorities the net profits of the trade after deducting a certain amount for working expenses and interest. A great reduction has been effected in the number of houses and in the convictions for drunkenness. All houses are closed from 6 p.m. on Saturday to 8 a.m. on Monday.

Gothic Architecture, the style of architecture which prevailed in Western Europe during the latter part of the Middle Ages. The term "Gothic," originally applied in contempt by the admirers of classical architecture, has survived the notion of rudeness and savagery which was formerly attached to everything mediæval, and is not likely to be displaced by "Pointed" or other substitutes which have been proposed. Gothic architecture is the highest type of the arcuated as distinguished from the trabeated method of building. [ARCHITECTURE.] After the irruption of the northern barbarians Roman architecture gradually declined, and various "Romanesque" styles, in which the Roman buildings were imitated, grew up in its place. The Romanesque styles of Western Europe were very inferior to the Byzantine (q.v.), but early in the 11th century there was a marked improvement. The increased skill of builders in the

Romanesque styles during the next century and a half led to the discovery of the principles of Gothic architecture. It arose almost simultaneously in England and France, and Early English and French Gothic are so much alike that they may be regarded as varieties of the same style. The general character of Decorated architecture is likewise the same in England, France (though the Hundred Years' War interfered with its development in that country), and Germany. It was only in its third stage, when it had begun to decay, that Gothic architecture followed a different course in England and on the Continent, diverging into the Perpendicular style in the one case and the Flamboyant (q.v.) in the other.

The history of Gothic architecture in England may, therefore, be regarded as typical of its normal development. Here, as elsewhere, it was of two kinds—ecclesiastical and domestic; but all its main characteristics were displayed on a more ample scale in the former than in the latter. Before proceeding to discuss the progress of English ecclesiastical architecture in detail, it may be well to point out the peculiarities of the English cathedral. It must be remembered that the form of the cathedral was determined by that of the Roman basilica (q.v.), which was afterwards modified by the addition of the transept (q.v.), while its upper stages became the clerestory (q.v.) and the triforium (q.v.). The English cathedrals became more strictly cruciform, owing to the rejection of the apse and the elongation of the choir and the wings which formed the transept. Some English cathedrals have two transepts. The cathedrals in this country also differ from those abroad in their greater length in proportion to their height.

The Anglo-Norman style, the English type of Romanesque [NORMAN ARCHITECTURE], gave way to the Early English—the first type of pure Gothic—through a process of gradual transition. Norman masonry was clumsy and wasteful, and, as the number of churches increased, it became necessary for builders to economise their materials. The introduction of the pointed arch—one of the chief features of Gothic architecture—must be in great measure ascribed to the requirements of vaulting. Vaults were now used over larger areas, and a new method was devised for vaulting over spaces of unequal span. Where the breadth of the space to be vaulted exceeded the portion of the length included in the bay or compartment, instead of the Norman expedients for equalising the height of the transverse semicircular arches and those at the sides, pointed arches were adopted in the latter position. This method is employed not only in the transitional triforium-arcade of Canterbury cathedral, but in the aisles of Fountains Abbey, which is still purely Norman in character. The use of the pointed arch in this and other Norman buildings of about the same date shows that it is not necessarily a mark of Gothic architecture. When the pointed arch came into general use in all parts of the building it was found that it could be more easily adapted to the purposes of vaulting than the semicircular. Other causes may have contributed to bring it into use. In St. Cross church, near Winchester, and on

the wall of Anselm's tower at Canterbury, the pointed form is produced by means of intersecting arcades. Some authorities maintain that it was introduced from the East by the Crusaders.

The Early English (or First Pointed) Style began at the close of the 12th and continued till the latter part of the 13th century. St. Hugh's choir at Lincoln (1192-1200) is the earliest example of pure Gothic. It has been asserted that the remains of the cathedral of St. Denis (about 1140) prove that the

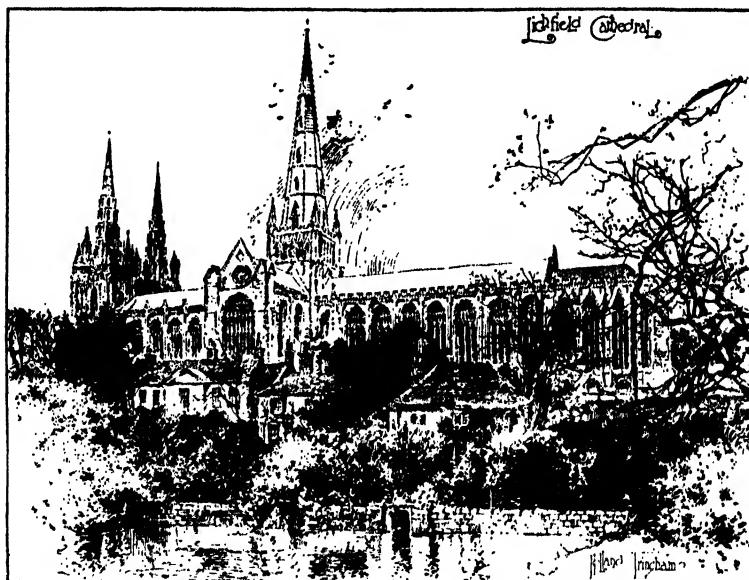


EARLY ENGLISH STYLE (ST. HUGH'S CHOIR, LINCOLN).

style originated in France; but St. Denis is transitional in character, and Dijon cathedral (consecrated in 1230) is the first French building which shows a complete emancipation from Romanesque traditions. Long narrow lancet-shaped windows and slender lofty pillars are the most striking features of Early English architecture. But the leading characteristic of the style is the bold outline of the mouldings, which consist of deeply-cut hollows alternating with firmly-carved rounds, and produce a strong effect of light and shade. The fillet is sparingly used at first, but becomes more common towards the close of the style. The windows are either single or are arranged in suites of two, three, five, or seven, which are sometimes placed so near one another that they resemble the lights of a single window, divided by mullions. The commonest forms of arch are the lancet and the equilateral. Trefoil arches are much used in doorways and other small openings. Small shafts are often placed in the jambs of doorways and windows, and form a mark of the style. The most characteristic form of pillar consists of small detached shafts surrounding a circular pier. The capitals have the shape of a reversed bell, and are often ornamented with the beautiful foliage peculiar to the style. It is termed "stiff-leaf foliage," owing to the stiffness of the stems, but the foliage itself is often free and luxuriant, and is deeply

undercut, so that it stands out in bold relief. Early English towers are generally higher than Norman towers, and most of them have or had lofty octagonal spires. The broach spire, which rises immediately from the outer surface of the wall without the intervention of a parapet, is a very common form. The roofs have a more acute pitch than the Norman, and the buttresses project more boldly. Flying buttresses spanning over the roof of the aisle, and conveying the thrust of the centre vault to the

style is far more ornate—but because in this style the decoration forms an essential part of the construction, and is not added afterwards to heighten the effect. This is especially true of the tracery in the windows. These are larger than in the Early English style, and consist of several lights, divided by mullions. The arches are usually two-centred. At first the tracery is always of the kind called "geometrical," consisting of circles, trefoils, and other geometrical forms. Subsequently



DECORATED STYLE (LICHFIELD CATHEDRAL).

(Fenton, Photo.)

side buttresses, and so to the ground, now became common. The vaults are invariably pointed and groined. They seldom have any ribs except the diagonal or groin ribs, the cross-springers or transverse ribs, and occasionally longitudinal and transverse ribs along the ridge of the main and cross vaults. Several kinds of decoration, highly characteristic of Gothic architecture, appear for the first time during this period. It became common to ornament the outside of the building with figures of saints, which were placed in niches, carved on the surface of the wall, and were often arranged in rows, as on the west front of Wells cathedral. The characteristic ornament of this style is the tooth-ornament, which is much used in hollow mouldings. The most beautiful examples of the Early English style are Salisbury cathedral and the choir and transept of Westminster Abbey.

The Decorated (or Middle Pointed) Style may be roughly said to cover the reigns of the three Edwards (1272-1377). It receives its name not from any superabundance of ornament—the Perpendicular

"flowing" tracery was introduced, so called because the stonework branches out into a variety of graceful curves. The finest windows which exhibit this form of tracery are those at the west end of York Minster and at the east end of Carlisle cathedral. Another kind of tracery common in the Decorated period is the "reticulated," in which the lines intersect like the threads of a net. There is a beautiful circular window with flowing tracery in the south transept at Lincoln. In cathedrals and large churches the pillars usually consist of four, six, or more shafts clustered closely together, instead of a central pier surrounded by detached shafts, as in the Early English style; and the prevailing outline of the cluster is that of a lozenge, instead of circular. The capitals are either plain or enriched with foliage. Real leaves, such as those of the oak, ivy, and vine, take the place of the conventional trefoil, and are often imitated with great fidelity to nature. They are sometimes represented as growing from a common stalk, which runs round the bell; in other cases each leaf is carved

separately. The mouldings are less bold than in the preceding style, but are usually extremely well carved, especially in early work. The roll, scroll, and quarter-round are the commonest forms. The larger members are generally filleted. Among the minor characteristics which distinguish this style from the Early English may be mentioned the



(Valentine. Photo.)

PENDPENDICULAR STYLE (MAGDALEN COLLEGE, OXFORD).

embattled parapets; the niches in the buttresses; the more general use of pinnacles, especially as a termination to buttresses; and the greater abundance of crockets and finials, which are the usual form of enrichment employed in the canopies over niches, the dripstones in the form of a triangle or an ogee which surmount doorways, and other situations of the same kind. The characteristic ornaments of the style are the ball-flower and the four-leaved flower, especially the former. Lichfield cathedral is a small but perfect specimen of purely Decorated architecture.

The Perpendicular (or Third Pointed) Style. Amongst the earliest examples of Perpendicular work are the choir and transept of Gloucester cathedral, begun about 1350, and the west front of Winchester (1360-66). The chief characteristic of the new style is the prevalence of perpendicular lines, which is most conspicuous in the tracery of windows. Horizontal lines are almost as striking a feature as perpendicular; for example, transoms or crossbars dividing the lights of a window into stages now become very common, and are often introduced several times in the height of the window. The doorways are commonly square-headed, and the spandrels between the arch and the outer mouldings are often richly carved. The general tendency of the style to adopt a rectilinear arrangement is very noticeable in the ornamentation; bands of trefoils and similar patterns are freely used to decorate the surface of walls, and sometimes walls and ceiling are almost completely

covered with panelling. The outline of the four-centred arch, which was now much used, was at first bold and impressive, but, as the style advanced, it became more and more depressed. The mouldings consist for the most part of broad, shallow hollows, and the round members have a very slight projection. On the other hand, the style has some characteristic beauties of its own. Among these must be reckoned the lofty and richly-ornamented towers: such as those of Magdalen College, Oxford, and many churches in Somersetshire; the open timber roofs which remain at St. Stephen's church, Norwich, and elsewhere in the eastern counties; and the beautiful fan-tracery vaulting in Henry VII.'s Chapel, Westminster, and St. George's Chapel, Windsor. In Henry VII.'s Chapel, pendants—a common feature of Perpendicular vaulting—are used with striking effect. Early in the 16th century the Perpendicular style was further debased by the admixture of elements derived from the classic styles, which gradually supplanted Gothic architecture, though it lingered on in the Oxford colleges as late as the 17th century.

Gothic Language, the oldest extant member of the Teutonic family. Of this, only one document (and that of the form used by the Moeso-Goths of the lower Danube in the fourth century) survives, the *Codex Argenteus* (Silver Codex), which is preserved in the University of Upsala in Sweden, and which contains portions of the Gospels and other fragments of the Gothic version of the Bible made by Bishop Ulfila, apostle of the Moeso-Goths, who died about the year 380. Gothic is usually spoken of as a member of the Low German in contradistinction to the High German branch of the Teutonic group; but at that time no such distinction existed, the High German not having yet been differentiated, and it would be more correct to say that it represents the oldest known form of Teutonic speech which was originally of exclusively Low German type. The correct form of the word is *Gotic*, as always written by the people themselves and by the Romans, but the vicious spelling *Gothic*, due to Greek influence, is now too firmly established to be set aside. The language continued to be spoken in Messia (the present Servia and Bulgaria) till the ninth century, when it died out without leaving any issue, as was the case with the Vandal, Burgundian, Lombard, and so many other Teutonic tongues spoken about the same period. [TEUTONIC LANGUAGES.]

Göthite (named after the poet Goethe (q.v.) in his less well-known capacity of Director-general of the mines of Saxe-Weimar) is a hydrous peroxide of iron, containing about 10 per cent. of water, which occurs in transparent red crystals of the Prismatic system, but, more commonly, opaque and yellow or brown. Its hardness is 5 to 5·5 and its specific gravity 3·8 to 4·4.

Gothland, or GOTTLAND, an island in the Baltic, off the S.E. coast of Sweden, and belonging to that country. It has an area of 1,080 square miles, and with the small surrounding islets forms the district of Visby, so named from the chief town, where is

the fifteenth century the outlawed King Eric X. maintained himself for ten years by piracy. The coast is rock-bound, but good pastoral and arable land exists in the interior, and there are valuable quarries of sandstone and marble.

Gottfried, a meistersinger of Strasburg, who flourished between the twelfth and thirteenth centuries. Of his history little is known, but he seems to have been of good family and to have held some municipal office in his native city. His great but incomplete work, *Tristan und Isolt*, deals with the popular Keltic legend of the Middle Ages. The poem consists of 12,552 rhyming lines, and displays great artistic power as well as deep knowledge of human nature. It has had a powerful influence over German literature. There are no other authentic remains of Gottfried save a few lyrics, the *Lobgesang* and *Gedicht von der Armut* no longer being regarded as his work.

Göttingen, the chief town of a circle of the same name in the province of Hanover, Germany, is built on both banks of the Leine river in a pleasant valley overlooked by the Hainberg. It is connected by railway with Hanover, 67 miles distant. A mere village in the tenth century, it became from 1286 to 1463 a prosperous member of the Hanseatic league (q.v.). The support which it gave to the Reformation and the misfortunes suffered in the Thirty Years' War reduced it nearly to ruin. In 1734 George II. founded the famous university of Georgia Augusta, and the fortunes of the town revived. A hundred years later the Liberal tendencies of the staff led to the expulsion of seven eminent professors and to the temporary decline of the institution. It has since recovered, and after the annexation of Hanover in 1866 the Prussian Government did much to restore its prestige. Among those who have filled chairs here may be mentioned the brothers Grimm, Ewald, Gervinus, Benfey, Haller, Hermann, O. Müller, Heeren, Blumenbach, and Heyne. Neander and the chemist Bünsen were natives of the town.

Gottschalk, or GOTESCHALCUS FULGENTIUS, the son of a Saxon count, was born about 808 A.D., and trained at Fulda for monastic life. As he grew up he tried to free himself from this career, but only succeeded in getting transferred to the French monastery of Orbais. Here he became an ardent student of the doctrines of Augustine. His views caused him to be cited before two synods, and he was sentenced to be whipped and imprisoned for life as a heretic and a disturber of the peace of the Church. For twenty years he languished in confinement at Hautvilliers near Rheims, Hincmar, the Archbishop, being his chief enemy. Though the question that he raised provoked dire controversy and still remains unsettled, Gottschalk, in spite of his entreaties and the influence of powerful friends, including the Pope, was never released, and on his death was buried in unconsecrated ground.

Gottsched, JOHANN CHRISTOPH, was born at Königsberg in 1700, and became Professor of Poetry in the university there, being transferred in 1734 to

the chair of logic and metaphysics at Leipzig. The great work of his life was the subjection of the German drama to the standard of classical criticism. His own writings for the stage were contemptible but he collected, under the title of *Die Deutsche Schaubühne* a number of plays by J. C. Schlegel and others, with some translations from the French. His most meritorious production, however, is his *Nothiger Vorrath zur Geschichte der deutschen dramatischen Dichtkunst*, in which he gives a fair but imperfect account of the efforts of earlier dramatists. He was a pedant, but he did something towards checking the extravagance in style and matter of some of his contemporaries. He died in 1766. His wife was a woman of culture, who translated the *Spectator* and Pope's *Rape of the Lock* into German.

Götz, JOHANN NIKOLAUS, born at Worms in 1721, became a theological student and ultimately a military chaplain at Halle. His fame does not rest, however, on divinity, but on his skill as a translator of Anacreon and a composer of light, elegant, and witty lyrics after the French school. *Thamire an die Rosen* and *An eine Romantisiererin* are good specimens of his style. He died at Württemberg in 1781.

Gouda, or TER-GOUWE, a town in the province of South Holland, Netherlands, at the junction of the Gow and the Yssel, eleven miles by railway from Rotterdam. It dates as a town from the end of the thirteenth century, and its early prosperity was derived from brewing, weaving, and the making of tobacco-pipes. It is now the great mart for Dutch cheese, and the Groote Markt is the largest in Holland. The town is well laid out and intersected by many canals, the suburbs being planted with trees. The church of St. John is a fine sixteenth-century structure, containing admirable painted glass and a famous organ. The Town House, rebuilt in the Gothic style (1690), has architectural merits. There is a large general trade both in imports and exports.

Gouge is a special form of chisel with its cutting edge shaped into the form of an arc. Gouges are much used in carpentry where curved hollows have to be cut, and in wood-turning where it is desirable that the cutting should be local, that the tool should be allowed a certain amount of play to right or left, and that it should be strong enough to resist sudden shocks.

Gough, SIR HUGH (VISCOUNT GOUGH) (1779-1869), was born at Limerick. In 1793 he joined the Limerick militia, and in 1795 became lieutenant in the 7th Highlanders. After being present at the capture of the Cape of Good Hope he went to the West Indies, rising to the rank of captain in 1803, and being in 1805 major in the 87th regiment, the Faugh-a-Ballaghs. He was present at Talavera, Barossa (where his regiment captured an eagle from the French), Tarifa, Vittoria, and Nivelle. After a period of partial retirement he was sent to India in 1837, and served in China, and again in India at Mudki, Sobraon, Chillianwallah, and Gujarat.

Gough, RICHARD (1735-1809), an English antiquary, was born in London. He showed when quite young a great aptitude for translation, and at sixteen wrote *Geography Modernised*. His chief works were an edition of *Camden's Britannia*, and *Sepulchral Monuments of Great Britain*. His books, etc., were bequeathed to the University of Oxford.

Goujon, JEAN, a French sculptor of the 16th century. In 1540 he executed a statue for the cathedral of Rouen, and then went to Paris, where he helped adorn the Louvre and St. Germain-l'Auxerrois. The *Diane Chasseresse* of the Louvre is said to be his work.

Gould, JAY (1836-1892), an American financier. His one ambition was to gain money, and he so manipulated railway stock as to become fabulously rich and to dominate the American stock markets

Gould, JOHN (1804-1881), an English ornithologist, was born at Lyme in Dorset. His father became foreman of the Royal Gardens at Windsor, and the son took great interest in natural history. In 1827 he was appointed curator of the Zoological Society's Museum. In 1832 he published *A Century of Birds from the Himalaya Mountains*, in 1834 *Ramphastidae*, in 1837 *Birds of Europe*. Other works of his are *Birds of Australia*, *Mammals of Australia*, *Family of Kangaroos*, *Birds of Great Britain*.

Gould, SIR FRANCIS CABRUTHERS (b. 1814), caricaturist, was educated privately, and for some years was on the London Stock Exchange. He has illustrated many books and periodicals, but is principally known for the cartoons contributed to the *Westminster Gazette*.

Gounod, CHARLES FRANÇOIS, born 1818 at Paris, an eminent French composer. He was educated at the Paris Conservatoire, and in 1839 went to Rome, where he gave his mind chiefly to religious composition. A result of this was his *Messe Solennelle*, published on his return to Paris. In 1837 the opera of *Sappho* appeared. His most admired work, *Faust*, was published in 1859. The other most important of his works are *Philemon et Baucis*, *Mireille*, *La Reine de Saba*, *Roméo et Juliette*, and *Polyeucte*. An oratorio, *Redemption*, was performed in Birmingham in 1882, and *Mors et Vita* was produced in 1885. His style shows a curious mingling of religious and secular treatment. He died in 1893.

Goura, a genus of pigeons, with two species, from New Guinea and the neighbouring island. They are large birds, with greyish-blue plumage, and large semicircular crest, nesting in trees, but seeking their food on the ground. *G. coronatus* is often seen in captivity. The flesh is excellent.

Gourami, the native name of *Oosphromenus vifox*, a fish of the family Labrinthici from the rivers of the East Indian Archipelago. The head is small, the body compressed and elevated, the dorsal and anal fins bear numerous spines, and the outer ray of each ventral is produced into a long filament. This species, which is a valuable food-fish,

is domesticated in the East, as the carp is with us, and is said to attain the size of a large turbot. It is one of the few fishes that build nests, and it watches over the young after they are hatched. The Fighting-fish (q.v.) is closely allied.

Gourd, a name given to various plants of the order *Cucurbitaceæ* and especially to the genus *Cucurbita* and to the fruit rather than to the rest of the plant. They are trailing annuals with palmately-lobed leaves, unbranched tendrils, and large yellow monoecious flowers, which hybridise so freely as to render it well nigh impossible to discriminate the parent specific forms of the long cultivated races. The fruit is inferior, and has a horny exterior when ripe. They are abundant in tropical and temperate Asia; but some may be indigenous in America. *Cucurbita maxima*, the yellow or red gourd, will grow in the south of England, and sometimes bears a fruit weighing over two cwt. *C. Pepo* is the pumpkin, which is largely cultivated, especially in the United States, as food both for man and beast. *C. ovifera*, the vegetable marrow, the form most grown in England, is apparently a variety of the pumpkin. *C. Melopepo*, the squash, with fruits of various subangular forms, is also largely cultivated in America. The elongated and well-named snake-gourds of India and China belong to a separate genus, *Trichosanthes*, as do also the bottle-gourds, *Lagenaria*, hollowed out in the East, when ripe, into bottles, basins, or spoons. All gourds have a tendency to secrete the powerfully purgative principle *coccygynthia*, especially in the ripe rind and seeds. [COLOCYNTH.]

Gout (derived from the Latin *gutta*, a drop) is a disease in which the substance called urate of soda becomes deposited in the cartilages of joints and in certain other situations. The name for this disease among the ancients was *podagra* (from two Greek words signifying an attack of pain in the foot). In the Middle Ages it was supposed that some morbid principle escaped from the blood into the joints, and hence arose the name gout. It is now known that the characteristic seizures of gout are always associated with deposits of urate of soda in the joints, that of the big toe being involved with especial frequency. Other changes in the tissues have been shown of recent years to be commonly associated with gout. Of these the granular or gouty kidney, and hypertrophy of the heart may be especially alluded to. Gout is most common in men of middle age, and there can be no doubt that heredity plays an important part in its production, and over-eating, over-indulgence in alcohol, and want of exercise are, apart from the inherited disposition, the three main factors concerned in the causation of gout. The first attack of the disease affects, as a rule, the right great toe joint. The pain usually commences, in the first instance, at night-time, and may continue (with intervals of comparative relief) for several days. Later attacks may extend to other joints, and, when the malady becomes chronic, these joints become swollen and deformed, and nodules may appear in the surrounding tissues, consisting

of uratic deposits. Thus the toes and fingers may be ultimately covered with what are called "chalk stones." Similar deposits affecting the lobe of the ear are termed *tophi*. Dr. Garrod has shown that the blood at the time of an attack of acute gout contains urate of soda in abundance. Gouty patients are usually liable to dyspepsia, and many other troubles occur in connection with the disease. The chief of these are headache, various neuralgic pains, palpitation, bronchitis, and emphysema, kidney mischief, bladder troubles, and various skin affections. Apoplexy is especially common in gouty subjects, and a peculiar, ill-understood, and serious group of symptoms sometimes supervenes immediately on the subsidence of an attack of gouty inflammation. To these the term "retrocedent gout" is applied. The treatment of the disease comprises first that of the acute inflammation, and secondly the general *regimen* to be adopted between the attacks. The most valuable drug for the relief of the pain and distress of acute gout is colchicum; lithia salts have also been much used in recent years. As regards *regimen* the most important point is the limitation in the amount of alcohol taken by the patient, best of all its complete exclusion from the dietary. Excess in eating is also to be avoided, in particular all kinds of flesh should be taken in limited quantities, and all rich and highly-spiced foods should be eschewed. Hot baths, Turkish baths, tonics, and regular exercise are valuable adjuncts in the treatment of chronic forms of the disease.

Govan. a town of Renfrewshire and Lanarkshire, on the S. bank of the Clyde, forming a suburb of Glasgow. The chief industry is ship-building. A public park of 40 acres was given to the town in 1885.

Government. The word "Government" denotes (1) the regulation of a political society; (2) those to whom this regulation is entrusted, or, in a more limited sense, those who take the chief part in the conduct of public affairs.

A political community, as Austin pointed out, is analysable into—on the one hand, a "sovereign" who issues laws sanctioned by a penalty in case of disobedience (such laws being distinguished from other commands as "positive laws"), and, on the other hand, a subject body which owes obedience to those laws. The sovereign may consist of one person or of more than one. A sovereign body may delegate its powers to a so-called "government," and at the same time retain the ultimate control over political action. It follows from this analysis that such an expression as "local self-government" is correct only in a limited sense, since the local body does not exercise sovereign authority. The sphere of government comprises both the affairs of a community itself and its relations with other communities. The control of these two departments or of the constituent parts of either of them may be vested in different bodies, so that the sovereign body proper becomes still more complex. This is the case when a state forms part of a federal union with a central authority, or occupies

a dependent or semi-independent position under a more powerful state.

Origin of Government. Ancient nations attributed their constitutions to the enactments of some semi-mythical legislator, as, for example, Solon and Lycurgus among the Greeks. The political struggles of the 17th century, combined with the growing spirit of inquiry, resulted in various attempts to explain the origin of government in general. The most important was the theory of the Social Contract, first promulgated by Hobbes (q.v.). The speculations of the time were all coloured by the desire to advocate some particular form of government. Hobbes wrote in support of the royal authority, and the same political views gave rise to the very different doctrine of the divine right of kings. Locke (q.v.), on the other hand, modified the theory of the Social Contract, so as to make it an argument for the maintenance of popular rights. In the 18th century the theory was revived in a new form by Rousseau (q.v.). In recent years the comparative method of inquiry has been applied to the study of early societies. The results so far obtained go to prove that the state resulted from a union of families or tribes under the hypothesis (often an almost avowed fiction) of descent from a common ancestor. Hence the rulers were supposed to represent this ancestor, and analogies from the organisation of the family were imported into the state.

Forms of Government. The organisation of most modern states is highly complex, including many institutions which represent earlier stages of national development and have lost much of their original significance, but are retained either through mere attachment to old traditions or in order to secure steady and uniform progress in the future. The sovereign power is thus divided unequally amongst several constituent parts, or those who really possess it occupy a subordinate place in the theory and external framework of the government, so that it becomes difficult to find any general principle on which to classify the states now existing.

If due allowance is made for altered conditions, the classification of the ancient philosophers, especially Aristotle, which was based on the numerical proportion between the rulers and the ruled, may still be considered applicable. Aristotle distinguished between the rule of one man, of the few, and of the many, and each of these is good or bad according as to whether it aims at the welfare of the community or the private interest of the ruler or rulers. We have thus three pairs of converse types—Monarchy and Tyranny, Aristocracy and Oligarchy, Commonwealth ("Politia") and Democracy. The rule of the few becomes an oligarchy when power falls into the hands of a small rich class, and that of the many a democracy when the government is carried on in the interests of the needy, who have nothing to lose and are always eager for change. The defects of Aristotle's exposition are the result of the political circumstances of his age. He had no notion of constitutional progress or representative government, and the value of his views, especially in regard to democracy, was further

impaired by the fact that they were drawn from a state of society in which most manual labour was carried on by slaves.

A proper understanding of the present systems of government can be acquired only by the study of constitutional history, which shows how the sovereign body in each country has gradually assumed its present form. The prevailing type is "constitutional monarchy"—an expression which is really self-contradictory, since monarchy implies a single ruler, and in this case the free action of the crown is limited not only by the terms of the constitution, but by the functions of those to whom it assigns a share in the sovereign power. Since the Revolution, England has been the model of a "constitutional monarchy," and her institutions have been imitated by various other countries. The tendency of this form of government seems to be towards democracy. The United States of America furnish a good example of a republic resting on a federal basis. Another principle which has been active in modern times is that known as Cæsarianism, in which the rule of an autocrat is supposed to be sanctioned by the consent of the governed.

Sphere of Government. The free discussion of political measures which has accompanied the growth of democracy has naturally raised the general question: "What matters ought to be subject to Government control?" On this question there are two schools: the supporters of *Laissez-faire* (q.v.), who would limit State interference to the protection of life, liberty, and property, and those who advocate "paternal government" or State Socialism. [SOCIALISM.] *Laissez-faire* became the ruling principle during the epoch which witnessed the revolutionary movement throughout Europe and the growth of the present industrial system, but recently there has been a strong reaction in favour of paternal government.

Governor, in *mechanical Engineering*, is a contrivance for regulating the speed of a machine. Every prime mover, such as a steam-engine or an electric motor, is liable to change of speed either by variation in the supply of power or by variation in the amount of work that it is made to perform. The governor is intended usually to regulate the supply of power according to the demand that is being made on the machine, but a contrivance such as a fly-wheel, which in some sense acts as a governor or regulator of speed, does not affect the supply of power to the engine, but acts as an accumulator of energy, from which all supplies for any external circuits must be drawn. [FLY-WHEELS.] Where the speed of the engine is to be rendered constant by regulating the supply of power given to it, it is usual for a governor to be introduced that is affected by fluctuations of speed, and that mechanically corrects the disturbance produced. Thus, if a steam-engine driving a quantity of machinery be suddenly relieved of its load by disconnecting the machinery, it will tend to increase its speed rapidly and dangerously. But if its crank-shaft be made to rotate a vertical spindle on each side of which heavy metal balls

are hanging, by centrifugal force these balls will fly outwards and upwards to a definite extent depending upon the speed of the crank-shaft. The supposed increase in the speed will lift the balls still higher, and by a simple mechanical contrivance they may be made to lift a collar on the spindle and through this to diminish the steam-supply to the engine. The old plan was for the governor to act on a throttle valve in the steam-pipe, which closed or opened as the governor balls rose or fell, but there was much waste of power at the valve, and it was a great improvement to make a governor act on the link motions (q.v.) that determine for what length of stroke steam is to be admitted to the cylinder. When the speed tends to increase, cut-off of the steam takes place early in the stroke. If the load is heavy and the speed tends to diminish, steam is admitted for a greater portion of the stroke. A gas-engine governor will regulate the amount of gas passing into the cylinder of the engine. When the load is light, little or no gas may be admitted, and the explosions are either very slight or else do not occur at all. It is still an objection with most governors that they are only brought into action by the occurrence of that which they are intended to prevent—that is, instead of preventing fluctuation, a governor can only act when fluctuation occurs. To avoid this it should be designed to work its mechanism with extreme rapidity—to act as soon as a tendency to fluctuation manifests itself. [STEAM-ENGINE, GAS ENGINE.]

Gow, NEIL (1727-1807), a noted Scottish fiddler, was born at Inver, near Dunkeld. He soon became renowned for his reels and strathspeys, and was much patronised by the great. His son, NATHANIEL, composed the favourite ballad *Caller Herrin'*.

Gower, JOHN (*circa* 1325-1408), an English poet, was born in Kent. He was a friend of Chaucer, and is alluded to by Shakespeare, who sometimes introduces him as a kind of chorus. Becoming blind, he retired to the Priory of St. Mary—now St. Saviour's, Southwark—and he partly rebuilt the church, in which he was buried. He wrote *Ballads and other Poems* in French, *Speculum Meditantis* (a treatise on married life), *Vox Clamantis*, in Latin elegiacs, and giving an account of the rising of the Commons in Richard II.'s reign, and *Confessio Anantis* (his best-known work), which is a curious but tedious collection of classic and mediæval tales with a slight binding thread running throughout.

Gown, a long, loose outer garment, worn by clergymen, members of universities, judges, and others. The ecclesiastical gown was originally intended for out-of-door use, but came to be used by preachers when addressing large congregations. The "Geneva gown," which resembles the academic, was introduced by the Geneva reformers, and continued in use amongst the Puritans and the Evangelical clergy. It is now rarely seen in the Anglican Church, but is still worn by Presbyterian and other Dissenting ministers. The purple gown is a distinctive mark of rectors of universities. In

Great Britain the faculty, as well as the university, of a graduate is now denoted by his hood. The members of the older English universities now have black gowns, for which a surplice is substituted in college chapel on Sundays and saints' days by those on the foundation. The academic gown is worn in the pulpit by university preachers.

Gowrie Conspiracy, a plot by Alexander Ruthven and his brother, the Earl of Gowrie, to murder or kidnap James VI. of Scotland, afterwards James I. of England, alleged to have taken place on August 5, 1600. The truth of the story has always been considered very doubtful, owing both to the strangeness of the details and the apparent absence of any motive on the part of Gowrie and his brother for wishing to kill or imprison the king. James, on the other hand, was indebted to the Ruthven family for a heavy sum, and may also have had political reasons for wishing to rid himself of the brothers.

Goya y Lucientes, FRANCISCO (1746-1829), a Spanish painter, born in the neighbourhood of Saragossa. He studied there, and at the age of 16 went to Madrid, where he distinguished himself by his wild life. He then went to Rome with a company of bull-fighters, and seems to have met with many vicissitudes of fortune. In 1775 he was back in Madrid, where he executed paintings for the royal tapestry factory. The king's painter took him up, and he was commissioned to execute some frescoes and other works. He was also successful as a portrait-painter, the Duke of Wellington being among his sitters; but his great forte was *genre*, and his paintings of bull-fights—a subject with which he was thoroughly acquainted—have been much admired.

Goyaz, capital of a province of the same name in Brazil, in the valley of the Velmeiro, a tributary of the Araguaia, 650 miles N.W. of Rio de Janeiro and 700 miles S.W. of San Salvador. It is the seat of a bishopric and of the Provincial Assembly, and has a President and a military governor. The streets are broad, and there are good houses and fine squares. Among the public buildings are the Legislative Chambers, the Court-house, hospital, prison, etc. It was originally called Santa Anna.

Gozzi, CARLO, COUNT (1772-1806), an Italian dramatist, was born at Venice. He joined the Granelleschi Society, which had for one of its objects the preservation of pure Tuscan literature. Gozzi aided in this by parodying Chiari and Goldoni, who had introduced the habit of imitating the French. His works, which were interpreted by the Sacchi Company and were in many cases pieces founded on fairy tales, were for a time very popular. They were published in 10 volumes in 1792.

Gozzoli, BENOZZO (latter half of the 15th century), was a Florentine painter who aided Fra Angelico, whom he accompanied to Rome, and by whose style he was greatly influenced. He painted a fresco of *St. Anthony and Angels*, a *Madonna and Child with Saints*, and many other works, among them being an altar-piece, *St. Thomas Receiving*

Our Lady's Girdle, now in the Lateran Museum. The frescoes in the Campo Santo at Pisa are attributed to him; at Perugia he painted a *Madonna with Saints*, and at Florence the *Journey of the Magi to Bethlehem*. The National Gallery, London, has a painting of his, *Madonna with Child and Saints*.

Graaf, REGNIER VAN (1641-1673), a Dutch physician and anatomist, was born at Schoonhoven. He studied at Leyden and in France, and took his M.D. at Angers in 1665, after which he practised at Delft. In 1668 he published a *Treatise on the Pancreatic Juice*, which brought him some renown. He studied much the organs of generation, and gave his name to his discovery of the Graafian vesicles of the ovum in 1672. His collected works were first published at Leyden in 1677.

Graafian Follicles. [OVARY.]

Gracchus, the name of a family of the Roman gens Sempronius. The first member of the family to attain importance was (1) TIBERIUS SEMPRONIUS GRACCHUS, who became *magister equitum* after the battle of Canne, and was consul 215-213 B.C. (2) TIBERIUS, who married Cornelia, daughter of Scipio Africanus, the model Roman matron, esteemed for the manner in which she devoted herself to the education of her children. This Tiberius conquered the Celtiberi, but won their hearts by the kindness and justness with which he treated them. He afterwards became consul, and as censor, though severe, was highly regarded. His two sons—Cornelia's "jewels"—were TIBERIUS and CAIUS, who were two of the most prominent men in Roman history. [ROME] The distinguishing features of all the family seem to have been loftiness of character combined with fascination of manners.

Grace, in its Scriptural sense, denotes both the free favour and love of God towards men, which they have done nothing to deserve, and the condition of those who enjoy this divine favour. Divines have distinguished between *common* or *general* and *special* or *particular* grace. The former is identical with the light of nature or conscience, and is granted to all mankind, while Christians alone receive the gift of special grace, which endows the recipient with spiritual knowledge and stimulates him to all good works.

Graces, Greek goddesses who were impersonations of all that is glad and beautiful in the world and in human nature. They are generally represented as the daughters of Zeus and Eurynome. Their names and number vary; according to Hesiod and Pindar, there were three—Aglaiia, Euphrosyne, and Thalia. They served Aphrodite, and conferred grace and beauty on human beings.

Gradient means the inclination of a road or railway to the horizontal. It is measured in terms of the vertical height ascended or descended for a given length traversed along the slope. If the fall along four miles of road be 44 feet, the gradient is said to be 11 feet per mile or 1 in 480. The choice of gradient is very important in the economy of railway design. The route is generally so planned that the amount of excavation in the formation of

the railway shall be roughly equal to the amount of embankment necessary where the route is to pass over low-lying levels. This condition usually imposes a limit on the gradient, though not necessarily so. Except in special cases where steep gradients are unavoidable, they are not allowed to exceed 1 in 60, the prevailing gradient on many good English lines being 16 feet to the mile or 1 in 330. If a high level has to be traversed, it is preferable to effect it in a series of short steep gradients with level interspaces between them rather than in a single uniform gradient upwards throughout the whole length. The locomotives are thus enabled to recover steam at each level stretch. Specially steep gradients require locomotives of unusual construction. Appliances for increasing the adhesive power on the rails are used, or else a pinion works in a toothed rack laid along the line of railway, so that retrograde motion can only occur when the teeth break. In the Zermatt railway in Switzerland the maximum gradient on the adhesive sections is 1 in 22, and on the rack and pinion sections 1 in 8.

Gradual, an antiphon or sentence, usually taken from the Psalms, which is sung to "plain chaunt" inclosures after the epistle in the Communion service. It was so called because sung whilst the priest was ascending the steps (*Latin gradus*) of the ambo (q.v.) to read the Gospel. The word also denotes a service-book containing plain chaunt melodies.

Graduation means the process of marking scales on measuring instruments. If the instrument is to measure some physical quantity directly, the scale reading may be marked in terms of that physical quantity, or it may be marked in inches of length, degrees of angular measurement, or in some other convenient numerical units, whose physical interpretation is obtained by calibrating the instrument. [CALIBRATION.] The simplest example of graduation is that of scales of linear measurement. This is done by a dividing engine, which consists essentially of a well-turned screw that can be made to move a sharp cutter through exactly equal distances, and thus mark the scale uniformly. Rough graduation may be effected by hand with the aid of compasses. For the accurate marking of a circular scale it is necessary, in the first place, to subdivide a circular arc into any number of equal parts. Though such an operation can be effected in the case of a straight line, no geometrical process is known by which a circular arc can be so divided; but any arc may be bisected, and the process of bisection of each half repeated indefinitely. Other subdivision may be done approximately by systematic trial with compasses. Circular dividing-engines consist essentially of a circular horizontal plate, carefully graduated and capable of rotation by means of a tangent screw. The cutter moves radially in one direction, and the scale to be marked is rotated with the graduated plate. The markings on metal or glass scales are made by coating the scale with wax, cutting lines on the wax with the compass or dividing-engine, and thus exposing the metal or glass underneath. This is then subjected to the action of acid, usually

nitric for metals and hydrofluoric for glass. When the wax is cleared away, the scale will be found permanently engraved.

Graffiti, rude scribblings scratched with a sharp instrument, or inscribed in red chalk or charcoal on the walls and pillars of ancient buildings in southern Italian towns. They are especially abundant at Pompeii, and there are several on the Palace of the Caesars and Nero's Golden House at Rome. They include both drawings and remarks or quotations, and have much the same general character as similar effusions of the present day, but some of them are memoranda relating to the events of daily life. Their importance consists in the light they throw on the life and speech of the people at the time. The graffiti found in the catacombs, which are of a different character, were placed there by the early Christians.

Grafting, or "WORKING," as gardeners sometimes term it, consists in the transfer of a branch, known as the *graft* or *scion*, from one plant to another, which latter is called the *stock*. It is essential that the cambium-layers or growing tissue of the two should be brought into close contact. The usual object of the process is to bring about earlier or more abundant flowering or fruiting, so that many stocks, from their effect on the scion, are what are termed *dwarfing-stocks*. The chief modifications of the process are (1) *whip-grafting* or *tongue-grafting*, in which the stock is cut back obliquely, a slice pared off one side and a notch made on the sliced surface, whilst the scion is cut obliquely and then a *whip* or *tongue* cut on its oblique surface to fit the notch, the whole being bound round with wet bast and clay; (2) *side-grafting*, which differs in no notch and tongue being made and the stock being often not headed back, the most frequent object of this process being simply to add a side branch to improve the form of a trained tree; (3) *cleft-grafting*, in which the stock is headed off horizontally and then cleft down the middle, the scion being cut into a thin wedge and inserted in the cleft; (4) *crown* or *rind-grafting*, in which a slit is cut in the bark and the scion inserted between it and the sap-wood; and (5) *root-grafting*, practised commonly in the case of dahlias and peonies, in which young shoots are inserted into a fleshy root, the junction being then covered with the soil. *Inarching* only differs from side-grafting in that the scion is not severed from its parent tree until its union with the stock is complete. As a rule, stock and scion, though united, retain their several characters; but undoubtedly cases of *graft-hybrids* occur, of which the most remarkable is *Cytisus Adami*, a tree bearing some branches, leaves and flowers intermediate in character between those of the common laburnum (*C. Laburnum*), its stock, and *C. purpureus*, its scion. [BUD.]

Grafton, AUGUSTUS HENRY FITZROY, DUKE OF (1735-1811), an English statesman descended from Charles II. In 1763 he entered practical politics as the opponent of Lord Bute, and two years later became Secretary of State in Lord Rockingham's

Government. In 1766 he was First Lord of the Treasury in Lord Chatham's Government, and owing to Lord Chatham's illness he had to manage the Government till his resignation in 1770. In 1771-75 he was Lord Privy Seal in Lord North's Administration, and in 1782 he took the same post under his old chief, Rockingham. His name has been familiarised to the world through the bitter attacks made on him in the *Letters of Junius*.

Graham. [CLAVERHOUSE.]

Graham, Sir James Robert George (1792-1861), an English statesman, was born at Naworth in Cumberland. He was educated at Westminster and Queen's College, Cambridge, and, after making a tour abroad, was appointed private secretary to the British Minister in Sicily. In 1818-20 he sat as a Whig in Parliament for Hull, changing his seat for that of Carlisle in 1826. He wrote upon *Corn and Currency*, and, having in 1830 been elected for the county of Cumberland, he became First Lord of the Admiralty under Lord Grey; but in 1834 he left his party, and joined the Conservatives. In 1838 he sat for Pembroke, and in 1841, while member for Dorchester, he became Home Secretary under Peel. At this time his views about the Scottish Church and his opening of letters which were in charge of the Post Office gave offence to many. In 1852 he was First Lord of the Admiralty under Lord Aberdeen, and in Lord Palmerston's Government, but the questions that arose over the conduct of the Crimean War caused his retirement.

Graham, Thomas (1804-1869), a Scottish man of science, was born at Glasgow, where also he graduated. After working at Edinburgh, he lectured at Glasgow, and afterwards was appointed Professor of Chemistry at University College, London. He was made Master of the Mint, a post which he held till his death, but which took him off from his scientific work. His researches were chiefly made in the direction of atomic motion, the passage and diffusion of gases, and the spontaneous movements of liquids.

Grahame, James (1765-1811), a Scottish poet, was born at Glasgow. He was educated at the university there, and studied for the Bar, but in 1795 he took orders in the Church of England, and became curate, first in Gloucestershire, then in Durham. His chief works are *Mary Queen of Scots*, *Sabbath*, *British Georgics*, *Birds of Scotland*, and *Poems on the Abolition of the Slave Trade*.

Grail. [HOLY GRAIL.]

Graining. [LEUCISCUS.]

Grains of Paradise, the export of which gave its name to the Grain Coast of West Tropical Africa, are the pungent seeds of *Anomomum Melegueta*, a member of the ginger family. They used formerly to be employed with ginger and cinnamon in making the spiced wine known as Hippocras; but are now mainly used in cattle-foods and cordials. They were perhaps once used by publicans to give a semblance of strength to beer, but their costliness would prevent this being done to any extent, even if it were not prohibited under heavy penalties.

They are not, however, deleterious, but are less aromatic than cardamoms (q.v.).

Grain Tin. When tin is refined, the purest portions are taken aside for the production of "grain tin." This is obtained by reheating the metal to a temperature just below its melting point, and allowing it then to drop from a height, when it breaks up into long prismatic masses which are known in commerce by the above name.

Grakle. GRACKLE, a common name for several tropical and sub-tropical birds of the Starling family. [MYNAH, STARLING.] The name, with some epithet, is loosely used in the United States for some of the Hang-nests (q.v.).

Grallæ. GRALLATORES (WADING BIRDS), an old order of Birds, in which were included cranes, herons, storks, bitterns, plovers, snipes, curlews, rails, etc. It was approximately equivalent to Orders x., xvii., xviii., xix., and xx. of Dr. Bowdler Sharpe's classification. [BIRDS.]

Gram, an Indian name for several kinds of pulse, especially the chick-pea (q.v.), Bengal or common gram, *Cicer arietinum*; the horse-gram of Madras, *Dolichos uniflorus* and *D. biflorus*; the green gram, *Phaseolus Mungo* and *P. Roxburghii*, and the black gram, a variety (var. *melanosperma*) of the former. They are largely eaten by the natives, and upwards of 15,000 tons are annually exported, chiefly to Mauritius, Ceylon, and Singapore, as horse- and cattle-food.

Grammar. The word "grammar" is used in three senses:—(1) The forms and usages of a language or of language in general; (2) the study of such usages; (3) a treatise or text-book in which they are explained. It will be well to begin by inquiring into the sphere of the study of grammar.

Grammar, the science of lingual sound, is a part of Philology (q.v.), the general science of language. It deals with the forms both of words and of sentences. Its starting-point is the sentence—the expression of a definite thought; for it is only when the sentence is formed that organised speech begins. The form of a word is determined by its relation to other words in the same sentence. But in some languages (called analytic) words do not change their form; in this case their mutual relations are expressed by the order in which they are arranged—in other words, by the form of the sentence. Even in synthetic or inflexional languages the relations of words are shown by their position as well as their form. Further than this, complex thoughts are expressed by the combination of several sentences, which enter into relations one with another similar to those of the separate words in a simple sentence. Grammar therefore, falls into two divisions:—Etymology, which deals with the forms of words, and Syntax, which is concerned with the arrangement of words in simple and of clauses in complex sentences.

The researches of philologists have shown that the laws of language can be ascertained only by studying its development and comparing languages one with another. Grammar is thus no longer confined to the schoolroom, but has become a

branch of inductive science. Side by side with the old formal grammar we have now *historical* grammar, which follows the growth of a single language, and *comparative* grammar, which is based on the historical grammars of allied languages, and traces their common forms up to their original source. As the comparative grammars of the Aryan, Semitic, and other families of languages become more firmly established, material will be furnished for *universal* grammar, which aims at expounding the principles common to all forms of speech.

In the Aryan languages (q.v.) comparative grammar has already made great progress. All the words in these languages may be regarded as having sprung from a small number of crude forms called "roots," each of which expresses some bare rudimentary notion, standing out of all connection with any other notions. With roots as such the grammarian is not directly concerned. They become words by means of three different processes: (1) their arrangement in sentences, (2) the addition of suffixes, (3) variations in the original vowels. The addition of a single suffix to the root sometimes gives a complete word, but more frequently a "stem" is first of all formed, from which words are afterwards developed by the addition of further suffixes. Thus, from *fat*, the Teutonic form of the Aryan root *pad* [GRIMM'S LAW], denoting motion, is derived the stem *fatu-*, from which is formed the Gothic substantive *fatu-s*, our *foot*, answering to the Latin *pes* (shortened from *ped-s*). Often a word is formed by attaching several suffixes, one after the other, with the same or a different signification. Flexion by vowel-change is of two kinds: "mutation" (German *umlaut*) and "gradation" (*ablaut*). Mutation is due to the influence of a lost inflexion. Thus, *man* became *men*, because the plural was originally formed in *i*. Gradation took place through a weakening of the root vowel. Thus, the *i* of the present *sing* and the *u* of the participle *prung* are weaker forms of the *a*, which appears in the past tense *sprang*.

Of our eight "parts of speech," the *interjection* alone has little or no history. *Interjections* are merely natural cries expressing emotion, and date from a period antecedent to the growth of grammatical structure. The origin of the *substantive* and the *adjective* is identical, for both an object and a quality of an object were expressed by a noun. The *pronoun* is simply a noun of wide application—*e.g.* *this* and *that* are words of larger meaning than the particular person or thing with reference to which they are used. The origin of the *adverb* is evident from the corresponding use of certain cases of nouns. Thus, in the sentence "The messenger arrived speedily," for "speedily" we can substitute "with speed," which before the loss of the case-inflection was represented by *spēdūm*, the instrumental or dative plural of *spēd*. In the same way "speedily" itself and all other adverbs were originally cases of substantives, adjectives, or pronouns. The adverb became a *preposition* when its force was further defined by the addition of a noun. Thus, in the sentence "He is putting on his coat," "on" is still an adverb, qualifying the verb "put;" but, in the sentence "He is

putting his coat on his back" it has become a preposition, connecting the coat with the back. The *conjunction* is an adverb or adverbial form used for the purpose of linking sentences or clauses. Most conjunctions were originally cases of pronouns, which were used with an adverbial force at the head of one clause to represent that going before.

The study of primitive word-formation and the evolution of the "parts of speech" shows that the Aryan languages have passed through two stages. The first stage was one of synthetic growth; during the second new parts of speech arose to take the place of the old inflexions. There was no sudden transition from one stage to the other, for word-formation never ceases entirely, and the inflexional element always remains predominant, but these languages show a general tendency to substitute an analytic for a synthetic structure. Some of the processes through which they have been developed may now be examined a little more closely. In the first place, in early times there was a greater variety in the forms produced through composition with inflexional suffixes. The conjugation of the verb, for example, was much more elaborate than it afterwards became. This change shows an unconscious effort after greater uniformity and simplicity in the use of grammatical forms. Again, the vocabulary was continually enriched by a more extensive use of prefixes and suffixes. The employment of suffixes at a late period to form new words is especially noticeable in the case of abstract nouns and adjectives. In the Teutonic languages, as in Greek and Latin, an immense number of compound verbs, expressing different modes of the same action, were formed by prefixing prepositions to simple verbs. The origin of the adverb is an example of the way in which an inflected form may become isolated or petrified, and eventually give rise to a new class of indeclinable words. Thus the termination of the Greek ablative survived as an adverbial suffix after it had disappeared from the declension of nouns, and could be used to form new adverbs of manner. This sometimes happens when the inflexion is not entirely lost. Thus, the genitive termination *es*, which remains in our possessive case, appears also in *needs* and *once*, which served as models for *always*, *sometimes*, and other later formations. Inflections disappear through natural decay, but the process may be hastened by accidental circumstances. In England the Norman Conquest had this effect. The Normans did not understand the English endings, and so they dropped out of use. The result is that English is less inflected than cognate languages, such as German. Finally, we must notice the influence exercised by literature in settling the form of a language. A standard is thereby given to which local usage conforms, and in this way the customary modes of expression become stereotyped. But a language always retains a certain amount of flexibility, and the grammar of each new generation differs in some degree from that of the preceding.

Gramme is the standard French unit of mass. Its weight at Paris is the standard of weight. A

gramme mass is defined as that of a cubic centimetre of distilled water at 4° C., the temperature of greatest density of the liquid. It is an equivalent mass to 15.43248 grains troy, but by reason of the difference of intensity of gravity in Paris and in London this number does not express the relation between their weights, one gramme weight being equivalent to 15.43234 grains troy weight or .00220462 lb. avoirdupois weight. The unit is divided into 10 decigrammes, 100 centigrammes, or 1,000 milligrammes; multiples of the gramme by 10, 100, 1,000 and so on, are termed the decagramme, hectogramme, kilogramme, myriagramme, and the quintal.

Gramont, PHILIBERT, COMTE DE, a French courtier (1621-1707), was the descendant of the husband of Henry IV.'s mistress. He distinguished himself in war, and his handsome person and witty mind made him a favourite at the Court of Louis XIV., from which, however, his dissoluteness caused him to be banished in 1662. He was received with open arms at the Court of Charles II., where he rivalled all in licentiousness. He married Miss Hamilton, and her brother Anthony wrote Gramont's memoirs.

Grampians. (1) Sometimes taken as signifying the chain from Dumbarton to Stonehaven, and sometimes as synonymous with the main system of the Scottish Highlands, and including Ben Nevis, the Ceirngorm Mountains, Schiehallion, etc. (2) A range in the W. of Victoria, Australia, 5,600 feet high.

Grampus (*Orca gladiator*), the sole species of the genus, the largest of the Dolphin family, and the only known cetacean that preys on its fellows. These animals, popularly called "killer-whales," hunt in packs, and attack even the Greenland whale. They are very widely distributed, the length ranging from 18 feet to 30 feet, and the colour is glossy black above and white beneath, with a white patch over the eye.

Granada, a province of Spain forming part of what was the old kingdom of Granada, on the N. coast of the Mediterranean, and E. of Malaga and Cordova, and containing 4,937 square miles. The W. and N. constitute parts of the Sierra Nevada, in which rise the Guadiana menor and the Genil flowing into the Guadalquivir, and the Rio Grande flowing into the Mediterranean. The climate of the valleys and of the coast is genial, and the plains, well irrigated from the times of the Moors downwards, are very fertile, producing wheat, barley, maize, wine, oil, sugar, flax, cotton, silk, and many varieties of fruit. The mining of lead, silver, copper, zinc, and manganese employs many hands. Near the town of Granada are found alabaster, jasper, and other precious stones. Mineral warm springs abound in many places. The principal towns are Granada, Motril, Alhama, Loja, Guadix and Huescar. The town of Granada is situated at the junction of the Darro and the Genil, near the base of the Sierra Nevada, and is built partly in the plain, partly on the slopes. The old town has much that is Moorish, and there are fine squares, as well as a shady walk called the Alameda. The

16th and 17th century cathedral is much ornamented with jasper, and contains the tombs of Ferdinand and Isabella. The church of our Lady has a good high altar and lofty towers. Gonzales de Cordova is buried in the monastery of St. Gerono. The Carthusian convent contains paintings by Murillo. The climate is pleasant and healthy, but there are few manufactures, and the silk trade, which flourished in the time of the Moors, has well-nigh decayed. Before the conquest in 1492 the Moorish kingdom was very populous, and took in also Malaga and Almeria.

Granadilla, the edible fruit of various species of passion-flower (q.v.) such as *Passiflora quadrangularis*, *P. edulis*, etc. It is somewhat insipid, and occasionally ripens in England.

Granatocrinus, the type genus of the *Granatocrinidae*, is of especial interest to English students, as it includes the commonest English representatives of the extinct class, the *Blastoidea* (q.v.); most of the European species originally named *Pentremites* belong to this genus. The *Granatocrini* are small globular blastoids with a flat base and are without a stem. The genus is typical of the Devonian and Carboniferous periods.

Granby, JOHN, MARQUIS OF (1721-1770), son of the Duke of Rutland, joined, in 1759, the army sent under Lord George Sackville to aid Prussia. After the battle of Minden the Marquis was made commander-in-chief of the British troops employed in the war. In 1766 he became commander-in-chief of the army at home. He was very popular, though Junius did not spare him from attack.

Gran Canaria, one of the Canary Islands, the capital of which is Las Palmas.

Gran Chaco, a district of South America between lat. 20° and 29° S., partly in Bolivia, partly in the Argentine Republic, and having an area almost twice that of France. The plain inclines S.E., and is in the basin of La Plata, being watered by the Pilcomayo, Vermejo, and other tributaries of the Paraguay. The great rains of the N. cause many marshes and lakes, while the dry steppes of the S. abounding in cactus plants are subject to extensive floods. The district is inhabited chiefly by Indians, and has abundance of forest and pasture, exporting cattle and, of late years, petroleum.

Grand Jury. [JURY.]

Grand Rapids, a city of the United States of America, capital of Kent county in the state of Michigan. It lies on both sides of the Grand river, near the rapids, and 30 miles E. of Lake Michigan. The river is navigable to the city, and there are steamers to Grand Haven and Lake Michigan. The town possesses two public parks, a public library, scientific institute, etc. The river falls 18 feet in 1½ miles, and the resulting water-power is utilised for the industries, of which the chief are furniture-, carriage-, and wagon-making, the manufacture of agricultural implements and machinery, the production of leather, beer and fruit, the making of bricks, and the quarrying of gypsum, which is abundant. Lumbering, too, is largely carried on.

Grandville, otherwise JEAN IGNACE GERARD (1803-1847), a French caricaturist, first gained fame in 1828 by his clever drawings of men with animal's faces, thus satirising most human weaknesses. Other similar works were *Animaux Parlants*, *Cent Proverbes*, *Fleurs Animées*. He also produced some political caricatures, and illustrated *La Fontaine*, *Robinson Crusoe*, and *Gulliver's Travels*.

Grangemouth, a port of Stirlingshire, 3 miles N.E. of Falkirk, took its rise in 1777, and now has extensive quays, docks, graving-docks, shipyards and warehouses. In the latter half of the 19th century there was an enormous increase in the shipping using the port. The Carron Company have works near by, and maintain a line of passenger steamers between the port and London. The imports consist of timber, hemp, tallow, deals, flax, grain, and iron, and the exports of coal and manufactured iron.

Granger, JAMES (1703-1776), an English print-collector and biographer, was born in Dorset. In 1743 he entered at Christ Church, Oxford, and having taken orders, was made vicar of Shiplake, Oxfordshire, and here he spent the greater part of his life. Among his works were a *Biographical History of England*, *An Apology for the Brutal Creation* (sermon), *The Nature and Extent of Industry and Letters*. The custom of cutting out engravings from one book to insert in another is known as "Grangerising" because Granger's history was adapted for this purpose.

Grangers, or "PATRONS OF HUSBANDRY," an American secret society founded in 1867. Its aim is to promote agricultural interests, especially by facilitating the transfer of farm produce and bringing the farmers into more immediate relations with consumers. It is also an educational factor of some importance owing to its libraries and literary entertainments. The organisation consists of a national "grange" with 34 state and numerous local granges. The movement has had much to do with the formation of the "Populist" party, which some years ago possessed influence in several states of the North-West.

Granite (from the Latin *granum*, a grain), is a rock made up of crystalline granules of orthoclase felspar, quartz, and mica, though often containing oligoclase or other plagioclastic felspar, hornblende, tourmaline, or other accessory minerals. Granite is classed as an *acid* rock, since it contains a percentage of silica, which, though occasionally as low as 58·4, is generally above 60, ranging from 62 to 81. Its chief other chemical constituents, on an average, are alumina 14·8, potash 5·1, soda 2·8, iron peroxide 2·2, and lime 1·6. The orthoclase crystals are sometimes, as in the granite of Shap Fell, several inches long, when the rock is termed *porphyritic-granite*, the plagioclase crystals being generally smaller. The felspars, varying in colour from white to deep pink, determine the colour of the rock as a whole. The quartz commonly fills the spaces between the other minerals and is clear and colourless, or milky from the presence of innumerable minute cavities containing saline water. The mica (q.v.), the least abundant of the

three typical constituents, may be either biotite muscovite, and appears as small dark plates. A variety in which hornblende partly replaces mica is called *syenitic granite*, the syenite of Pl. named from Syene, the modern Assuan (q.v.) where Cleopatra's Needle, which is composed of this rock, was quarried. Another variety, known as *graphic granite*, is strictly a *granulite*, since it contains no mica. It consists of a flesh-coloured orthoclase with plate-like crystals of quartz presenting in transverse section a striking resemblance to Hebrew letters. Formerly granite was looked upon as the primitive rock of the earth's crust; but it is now certain that some granites even of Tertiary age. All granites, however, probably *plutonic*—i.e. have consolidated down, under great pressure, though, whilst the rock is often undoubtedly *intrusive*, having been thrust while completely fused into narrow veins, altering the penetrated rock, in other cases it is looked upon rather as *metamorphic*, passing it apparently does, insensibly into gneiss (q.v.), so into stratified deposits. Granite generally forms rounded hills, but may rise in pinnacles, *aiguilles* of the Alps. It weathers by the hydration of its felspar into *kaolin* or *china-clay* (q.v.) and this, taking place along the rectangular joints by which the rock is sometimes traversed, gives rise to heaped-up masses of cuboidal blocks, resembling Cyclopean masonry, known as *tors* of Devon and Cornwall. The grey granites of the two counties and of Aberdeen are largely quarried for building purposes, for bridges, sea-walls, kerbstones, etc. The pink granite of Peterhead especially employed in a polished form for tables and other ornamental purposes, and the two syenitic granites of Charnwood Forest, Leicestershire, and of the Channel Islands, are among the best road-metals for macadamised roads.

Grant, a form of conveyance formerly particularly applicable to incorporeal hereditaments, but now in use for corporeal as well as corporeal hereditaments. The use of the word "grant" is, however, no longer necessary in conveyance, the word "convey" being now sufficient in all cases. Where a reversion or remainder is the subject of transfer it was formerly necessary that the tenant of the particular estate should attorn to the grantee, but by a statute passed in the reign of Queen Anne this requisite is dispensed with.

Grant, SIR ALEXANDER (1826-1884), was born at New York. He came young to England, then went to the West Indies and, returning to England, went to Harrow in 1839, where he distinguished himself both in and out of school, becoming a member of the Eleven and gaining Balliol scholarship. In 1849 he was elected Fellow of Oriel, and remained in residence for years. He published in 1857 his edition of *Ethics*, which for long remained a standard book. In 1855 he had been made Examiner for Indian Civil Service, and from 1860-68 he filled many public educational offices in India. He

succeeded Sir David Brewster as Principal of Edinburgh University. He did much other classical and literary work.

Grant, CHARLES, LORD GLENELG (1779-1866), was born in India. He was educated at Magdalene College, Cambridge, graduating M.A. in 1804, and writing a prize-poem in 1805. In 1811 he entered Parliament for the Inverness burghs, and afterwards sat for the county till 1835. In 1819 he was Secretary for Ireland, and 1823-27 Vice-President of the Board of Trade. From 1830-34 he was President of the Board of Control, and 1834-39 Colonial Secretary. He then retired, and died at Cannes.

Grant, SIR FRANCIS (1803-1878), a portrait-painter, was born at Edinburgh. He prepared for the Bar, but at 24 turned his attention to painting. In 1843 he exhibited at the Royal Academy, and was very successful in hunting scenes; but he abandoned this line for portrait-painting, and had many celebrities, among them being Scott, Macaulay, Disraeli, Derby, Palmerston, Russell, and Landseer. He became A.R.A. in 1842, R.A. in 1857, P.R.A. in succession to Sir C. Eastlake, in 1866.

Grant, SIR JAMES HOPE, brother of the above Sir Francis (1808-1875), became cornet in the 9th Lancers in 1826. In 1842 he was brigadier-major in the China War, and took part in the battle of Sobraon in the first Sikh War. In the Punjab campaign (1848-49) he commanded the 9th Lancers, and was present at Chillianwallah and Gujarat. In the Mutiny he commanded a cavalry division, and had a great part in the relief of Lucknow and the subsequent operations. He was made major-general, commander of the army of pacification, and K.C.B. In 1859 he took part in the China expedition, and was made G.C.B., and after holding various commands at home and abroad became general in 1872.

Grant, JAMES (1822-1887), novelist, was born at Edinburgh, and at 12 years old went to Newfoundland. In 1839 he was gazetted ensign in the 62nd Infantry, but did not stay long in the army. His first novel, *Romance of War*, dealt with the Peninsular War, while the next, the *Aide-de-Camp*, illustrated the Calabrian expedition. Other well-known novels are *Frank Hilton*, *Harry Ogilvie*, and the *Highlanders of Glen Ora*. He also published a work on *British Battles*.

Grant, JAMES AUGUSTUS, COLONEL, C.B., F.R.S. (1827-1892), was a native of Nairn. He was educated at the grammar school and at the Marischal College, Aberdeen. In 1846 he entered the Indian army, and was present at Gujarat, and later saw service during the Indian Mutiny. In 1860-63 occurred the noted Speke and Grant expedition to look for the sources of the Nile, and in 1868 he took part in the Abyssinian campaign. He wrote *A Walk across Africa*, *Botany of the Speke and Grant Expedition*, and *Khartoum As I Saw It*.

Grant, ULYSSES S. (1822-1885), an American General, and President of the United States of America, was born at Point Pleasant, Ohio. From

1839-43 he was at the United States Military Academy, and afterwards served in the Mexican War. For a considerable period he was employed in a tannery at Galena, Illinois, but the Civil War of 1861 called him from retirement, and he was made Colonel of the 21st Illinois Infantry. He then became Brigadier-General, and Commander of the district, and fought several battles. At the decisive battle of Shiloh (1862) General Johnston was killed, and in 1863 Grant took Vicksburg. In 1865 he was Commander-in-chief, and at the head of the army of the Potomac, in conjunction with his subordinate generals at the head of other armies, he concentrated his forces upon Richmond, the fall of which ended the war. In 1868 and again in 1872 he was elected President of the United States. There was even a movement for his nomination for a third term, but the plan was abandoned as being contrary to the spirit of the Constitution. Unfortunately he was not careful to check corruption in his subordinates, and there were serious scandals while he was President, though he was not personally implicated. In 1884 a reverse of fortune caused him to undertake a history of the war, and in spite of a fatal and painful illness, which he bore with great fortitude, he accomplished his task.

Grantham, municipal and parliamentary borough and market town of Lincolnshire, is on the Witham, and 22 miles S.W. of Lincoln. The thirteenth-century church, restored by Sir G. Scott, has a spire 274 ft. high, and contains many monuments. Besides the grammar school, founded by Bishop Fox in 1528, there is a guildhall, a town-hall, two exchanges, a literary institute, and a bronze statue of Sir Isaac Newton. The chief industries are malting, tanning, coach-building, agricultural implement-making, and iron-founding. Pop. (1901), 17,593.

Grantia, a small simple calcareous sponge belonging to the order Calcarea. It is common round the English coast.

Granulation Tissue, the tissue filling up the base of an ulcer, or covering a wounded surface.

Granvella, ANTOINE PERRENOT, CARDINAL (1517-1586), was born in Burgundy, his father being Chancellor of the Empire. In 1540 the son became Bishop of Arras, and in 1560 Secretary of State, and Chancellor in succession to his father. After the abdication of Charles V. he negotiated the marriage of Philip and Mary, and was afterwards Prime Minister to Margaret of Parma in the Netherlands. In 1560 he became Archbishop of Malines, and in 1561 Cardinal. His severity raised great hostility in the Netherlands, and he found it prudent to retire. Later he went to Rome, and was for a time Viceroy of Naples, and he had just been appointed to the see of Besançon when he died.

Granville, GEORGE LEVESON-GOWER, EARL (1815-1891), an English statesman, was educated at Eton and Oxford. In 1836 he became M.P. for Morpeth, and in 1840 for Lichfield. He soon was appointed Under Foreign Secretary, and in 1846 succeeded to the earldom. In 1851 he joined Lord

John Russell's Government, and in 1853 was President of the Council. In 1865 he was appointed Lord Warden of the Cinque Ports, and in 1868 was Colonial Secretary in Mr. Gladstone's first Government. In 1870 he became Foreign Secretary on the death of Lord Clarendon, and in this capacity carried on the negotiations which secured the neutrality of Belgium, and those which arranged with Russia the position which Afghanistan should occupy as between Great Britain and Russia. In 1880 he was again Foreign Secretary, and Colonial Secretary in the short-lived Government of 1886.

Grape. [VINE.]

Grape Animals, a group of Ascidians (q.v.) belonging to the family *Botryllidae*, so called because they grow in grape-like clusters.

Grape Shot, a mass of spherical bullets, packed together in an open frame of cylindrical shape, fitted for discharge from a gun, and so arranged as to break up soon after leaving the muzzle. In the old sea-service there were always nine balls in a grape-shot, which was then formed in a canvas-bag strongly corded together and quilted with packthread. The weight of the balls varied from 4 lb. for a 42-pounder to 1 lb. for a 12-pounder, and 6 oz. for a 4-pounder.

Grape Sugar. [DEXTROSE.]

Graphic Mathematics signifies the solution of problems in pure or applied mathematics and physics by means of scale drawings. The solutions to algebraic equations may be obtained by drawing the curve represented by the equation that requires solution. [GEOMETRY.] The distances of the points of intersection of the curve with the axis of x from the origin of co-ordinates represent to scale the numerical solutions of the equation. Various surd (q.v.) quantities may be represented by means of the known connection between the three sides of a right-angled triangle. Thus the hypotenuse of that right-angled triangle whose remaining two sides are each 1 inch in length is $\sqrt{2} \times 1$ inch, a length which can be seen by the eye, but cannot be exactly given as a fraction of an inch. The quantity $\sqrt{3}$ is the length of the side of a right-angled triangle whose hypotenuse is 2 inches long and other side 1 inch. Similarly for other simple surd quantities.

The subject includes all processes of determining the composition and resolution of forces, the positions of the mass-centres of various figures, the intensity of stresses in the various members of a given structure, and other dynamical problems, all of which are generally classed together under the head of GRAPHIC STATICS. It is essentially the study of vector- and rotor-addition. The resultant of two forces acting at a point may be determined graphically by the parallelogram of forces, and if at a point three forces are in equilibrium there must be a connection between them which is formulated in the theorem known as the triangle of forces. This is the ordinary basis of solution of the various problems in the practical part of the subject, which frequently admit of simple and elegant solutions by graphical methods where calculation would be difficult.

Graphite, PLUMBAGO, or BLACK LEAD, is a form of carbon (q.v.) which has no connection with lead, save in colour and lustre. It is black, but has a silvery metallic lustre, is unctuous to the touch, soiling the fingers, and has a hardness of 0·5 to 1, and a specific gravity of 1·9 to 2·3. It generally occurs in scales disseminated through limestones, slate, or mica-schist, or in more considerable beds in a massive form, as in the Laurentian rocks (q.v.) of Canada, where the total thickness of the beds is said to exceed that of the coal-seams in the Coal-measures of England. Very rarely it occurs in six-sided crystalline scales, which are believed to belong to the Oblique system. It does so at New Cumnock, in Ayrshire, where its formation is owing to the penetration of a coal-seam by an igneous dyke, and it does so also on the surface of the pigs of inferior or "mottled" cast-iron when too much coal has been added to the ore at the top of the blast furnace. The graphite of Borrowdale, near Keswick, is practically exhausted, and we draw our supplies from Ceylon, Siberia, and Finland, our annual imports being about 14,500 tons, of the value of £192,000. Graphite is used for "black-lead" pencils, for polishing ironwork, so as to protect it from rust and in the manufacture of crucibles.

Graphitic Acid, the name applied by Brodie to a substance obtained by the action of potassium chlorate and nitric acid upon graphite. It forms small yellow crystals slightly soluble in water. The formula $C_{11}H_4O_5$ has been given to the substance, which has not, however, been well investigated. It appears of interest that neither of the other forms of carbon yield this substance by similar treatment.

Graphotype, a process which was intended to supersede wood engraving, but which only met with a very partial success. The mode of working was as follows:—A plate of zinc was coated with powdered French chalk, subjected to considerable pressure and sized. The drawing was then made by means of finely-powdered charcoal and lamp-black mixed with gelatine and water. The chalk between the lines was afterwards brushed or rubbed away to a depth of $\frac{1}{16}$ th inch or more, the lines remaining owing to the hardening action of the ink employed. From the block so obtained, a mould was taken from which stereotype blocks, etc., were made and used for the printing.

Graptolites, an extinct class of Hydrozoa (q.v.) which lived only in the Cambrian, Ordovician, and Silurian periods. They were all compound animals, and appear to have been always free-swimming. They consisted of two main parts, a numerous series of polypites united by a common flesh or "cenosarc"; they are represented now by the chitinous skeleton by which they were protected. This consists of the cuplike "hydrothecae" in which lived the polypites, and a tubular rod upon which these are placed. At the first-formed or proximal end is a small expansion known as the "sicula," which was the original cell, which either persisted during life as a float, or a vesicle for this

purpose is formed from it. The sicula is the earliest known stage in the life history of the graptolites; the next stage is the "virgula," in which a small rod grows up from the sicula; upon this the hydrothecæ are formed, and the graptolite stage is reached. A rod sometimes also grows downward from the sicula, and this is known as the radicle. The rod bearing the hydrothecæ consists of two parts, a solid cord or axis, and a hollow tube on one side of this: this tube or common canal contained the coenosarc. The reproductive organs of the graptolites are not certainly known, but there is little doubt that certain small cuplike organisms, frequently associated with the graptolites, are the "gonophores" which protected the eggs; similar gonophores occur in the Sertularians (q.v.), which are the nearest living allies of the graptolites. These structures were described as *Dawsonia*, and until they have been found actually united with a graptolite their nature must be regarded as doubtful. The graptolites are classified according to the arrangement of the hydrothecæ on the axis; as a rule they overlap, but in one group—e.g. *Rastrites*—they are loosely scattered. The graptolites with overlapping hydrothecæ are divided into the "Monopriodon" and "Dipriodon" groups: in the former the hydrothecæ are placed on one side only of the axis, as in *Monograptus*, *Tetragraptus*, etc., while in the other they are placed on both sides, as in *Diplograptus*. In one family they occur on each side of an expanded plate, giving the colony a leaf-like form: such are known as the *Phyllograptidae*.

Grasmere, a village in Westmoreland, half a mile north of the lake of the same name, which is celebrated for its beauty, and about 4 miles N.W. of Ambleside. The church is that described in the *Excursion*. Wordsworth and Hartley Coleridge are buried in the churchyard. Pop. (1901), 781.

Grass-cloth. [BOEHMERIA.]

Grasse, HENRI, COMTE DE, French admiral, was born at Valettes, Provence, in 1723, and is best known as having been the adversary of Hood, off Martinique, 1781, of Graves in Lynn Haven Bay in the same year, and of Rodney off St. Christopher, and again off Martinique in 1782. He died in 1788.

Grasses, a large group of monocotyledonous plants constituting the natural order *Gramineæ*, and comprising about 4,500 species in about 250 genera. The term is popularly used for many green herbaceous plants which are not members of this order, the limits of which were first suggested by the classification of Linnaeus (q.v.), in which most true grasses appear under the order Digynia of the class Triandria, having two styles and three stamens. Grasses occur in all climates, those of temperate regions being generally herbaceous and "social," i.e. growing together in great numbers and considerable variety, and so forming "pastures," whilst in warmer countries they are often in tufts or arborescent, some bamboos (q.v.) having 50 or 60, or even upwards of 100 stems. The roots are fibrous and the stems generally cylindric, with

swollen nodes and hollow and elongated internodes, though the sugar-cane (q.v.) has short and solid internodes. The perennial forms have commonly creeping rhizomes, with solid internodes, from which the erect aerial branches or culms (q.v.) often themselves branched, grow with great rapidity, a bamboo even reaching 100 feet in two months. The culm secretes a large amount of silica in its epidermal cells, and becomes hard and polished externally. The leaves are distichous, have a long sheath forming a generally split tube embracing the internode, seldom with any petiole, but with a membranous outgrowth, or *ligule*, at the base of the long, narrow, linear, tapering blade. The flowers are very variously grouped in racemes or panicles of small spikes, or *spikelets*, and are generally bi-sexual, though maize and some of the arborescent forms are monoecious. Each spikelet has generally two *empty glumes* (q.v.) at its base, and may contain one, two, or many flowers besides other empty glumes or "barren flowers." Below each flower there are usually two glumes at different levels, belonging, in fact, to distinct axes. The lower of these, the *flowering glume*, is often furnished with an *awn* (q.v.) either at its apex or springing from it dorsally, which represents the blade of a leaf. The upper glume or *pale* is membranous, and has two lateral veins and no midrib, representing two united bracteoles. It is close below the flower. The outer perianth-whorl is almost always suppressed, and the inner one represented by two minute hypogynous scales known as *lodicules*. There are three of them in bamboos, and six in *Streptophyllum*. There are usually three stamens alternating with the lodicules, and belonging, therefore, to an outer whorl; but in rice (q.v.) and most bamboos there are six, in two whorls, and sometimes more, or only two or even one. They are commonly exerted, with long weak filaments and pendulous versatile anthers with lobes diverging at each end. The gynoecium consists typically of two carpels united into a one-chambered ovary with two distinct styles and feathery stigmas, the flowers being commonly wind-pollinated. In a few cases there is only one style, which in maize (q.v.) reaches a length of six inches, and in some bamboos there are three. In all cases there is but one ovule, which generally entirely fills the ovary. The fruit or *caryopsis* is commonly deeply grooved down the line of junction of its carpels and is very rarely fleshy. In *Crocosmia* it is enclosed by a strong white polished bract or involucre, whence it has the name of "Job's tears." The seed is mainly filled with mealy endosperm, the embryo lying at one side of its base.

The value of grasses depends primarily on their farinaceous fruit or "cereal grains," the chief bread-stuffs and staple food of the world; secondly, on the use of their herbage, either green or as hay for fodder for cattle; thirdly, on the sugar of their sap. The chief cereals, wheat, rice, maize, barley, oats, rye, and millet, are dealt with in separate articles (q.v.). Among the chief fodder-grasses are rye-grass (*Lolium*), Timothy-grass (*Phleum*), *Cynodon* and *Anthoxanthum*; and the tussac-grass, *Festuca flabelloides* of the Falkland Islands.

Besides the sugar-cane (q.v.), sugar is obtained from various species of *Sorghum*. The Esparto-grass, *Macrochloa tenacissima*, and Alfalfa, *Lygeum spartum*, are both used as paper materials, as also is the straw of the cereals and the bamboos, whilst the latter group have endless uses as a light strong timber. Finally the fragrant oils of geranium, ginger-grass, obtained from East Indian species of *Andropogon*, must be mentioned.

Grasshopper, a group of insects belonging to the order Orthoptera (q.v.). They are represented in England by two families, the *Locustidae* and the *Gryllidae*. The commonest and most familiar forms are the small green grasshoppers belonging to the *Locustidae*; the commonest English species is *Rhammatocerus biguttulus* (Linn.). This family is characterised by the length of the antennæ or feelers, and by having four joints in the tarsal portion of the leg. The *Gryllidae* are as a rule larger than the *Locustidae*; thus one English species, the great green grasshopper (*Phasconura viridisissima*, Linn.) measures 4 inches in expanse of wing; the members of this family all possess an ovipositor—a sharp tube by means of which it deposits its eggs in a suitable nūdus. Most of the grasshoppers can make a slight chirping noise, but in some of the *Gryllidae* this attains a high degree of development: thus some of the Brazilian species (e.g. *Chloroscelus tanana*) are kept in cages on account of their song.

Grass Moths, a family of Microlepidoptera known as the Crambidae; they live in meadows, spending most of their time hidden in the grass. As their wings are compactly folded into a kind of tube, they are very small when at rest, but appear comparatively large when the wings are expanded in flight.

Grass Oil, a name given to the volatile oil obtained from various plants, and distinguished further as ginger grass oil, Turkish grass oil, etc. Many varieties are known, differing in their uses and chemical composition, and employed for various purposes in medicine, for cosmetics, perfumery, etc.

Grass-tree, a name applied in Australia to the various species of the liliaceous genus *Xanthorrhœa*. They have thick palm-like stems, which when blackened by bush-fires give the plants the name of Black-boys, and a dense terminal tuft of long grass-like leaves that furnish good fodder. The stems exude abundance of fragrant resin, either yellow Botany Bay or Acaroid resin, or red Black-boy gum. From them also picric acid (q.v.) is obtained. The similar juncaceous plant *Kingia australis* is known by the same name.

Grate. It is of importance in the combustion of coal for heating purposes that the furnace should be properly constructed so as to fulfil the special objects for which the furnace is required. In the ordinary fireplaces required for the warming of houses, it is customary to have grates of about 24 inches in width and 6 inches in height placed close to the floor so that the requisite draught to the fire may be low-lying, and so that there may be

less danger of accidents by fire. The draught is very slight, just sufficient to induce a continual upward current of burnt gases through the chimney and to effect a slow and steady combustion of the fuel. When the fuel is incandescent it is desirable that it shall be burnt away as slowly as possible, for there is then less waste by convection of hot gases up the chimney and more radiation of heat into the room. Kitchen ranges require the heat to be localised to a greater extent, and the grate is therefore much closer. Also, it is usual to conduct the hot gases past the ovens so that part of their heat may be utilised. In engineering the design of grates for steam boilers is of much importance. It is necessary that the area of the grate shall be carefully estimated. This is obtained from determinations of the amount of water that has to be converted into steam per hour. It also depends upon the shape of the boiler and its flues, and in fact the area of fire-grate is usually approximated by comparison with already-existing examples that are working well. The number of pounds of coal burnt per square foot of fire-grate per hour varies from about 4 in large Cornish boilers to 140 in locomotives. Such grates as these consist of parallel fire-bars about 3 feet in length supported on cross-bars, the whole forming an area about 6 feet in length and from 15 to 50 inches in width.

Gratianus, AUGUSTUS (359–383), Roman Emperor, son of Valentinian I., was born at Sirmium in Pannonia. While still a child he accompanied his father in a campaign against the Alemanni. On his death in 375, he became ruler over the Western Empire in conjunction with his younger brother, Valentinian II., Gaul, Spain, and Britain being allotted to Gratian. The early part of his reign was occupied with wars against the Alemanni and other barbarians. In 378 he succeeded his uncle Valens (q.v.) as ruler of the Eastern Empire, but gave a share in the sovereignty to Theodosius (q.v.). Gratian's private character was estimable, and his hostility to paganism secured the favour of the Church, but his luxurious habits made him unpopular with the army. Maximus was proclaimed emperor by the legion in Britain, and, after a defeat near Paris, Gratian fled to Lyons, where he was slain by one of his adversary's adherents.

Gratings, in experimental *Optics*, are plates of glass or speculum metal on which are ruled parallel lines equidistant from each other, and sufficiently close to form diffraction spectra of the light that passes through or is reflected from the grating. By means of such diffraction gratings the wave-lengths of light of different colours have been most accurately determined. For ordinary purposes 10,000 lines to the inch will suffice, but for more accurate work double that number are desirable. The process of ruling these lines was well elaborated by Nobert, but has been much improved by Professor Rowland, who has succeeded in ruling over 40,000 lines to the inch. The process of ruling depends upon the action of a well-made screw, which takes months to make. Rotation of this produces motion of a cutting diamond, which is

thus moved onwards slightly, after cutting each furrow in the glass or metal. The grating may be spoilt by wearing down of the cutting point, which will then produce more than one furrow at a time. The lines will be scratchy if the point is too hard, and the avoidance of such practical difficulties as these may render a search after suitable diamonds one of months' duration. It takes five days and nights to rule a six-inch grating with 20,000 lines to the inch. Fairly good gratings may be produced by photography, which readily provides the means of obtaining diminished copies on glass of equidistant parallel lines.

Grattan, HENRY (1746-1820), the Irish patriot and orator, was born in 1746. After an education at Trinity College, Dublin, where he became an accomplished classical scholar, Grattan, at the age of twenty-one, entered the Middle Temple, and in 1772 was called to the Irish Bar. In 1775, in consequence of Flood's recommendation to the Earl of Charlemont, he was returned to the Irish Parliament as member for the borough of Charlemont, and rapidly acquired the popularity and influence which were now withdrawn from Flood. The fortunes of Irish commerce were then at a low ebb, mainly owing to the restrictions on exportation imposed by the English Parliament, and the agitation for their removal became so formidable that in 1780 Lord North was compelled to abandon the greater number. Grattan now became the champion of legislative freedom, and in 1780 delivered the famous speech in which he maintained that the Crown is competent to legislate for Ireland with the co-operation of the Irish Parliament alone. The Convention of Dungannon in February, 1782, was followed two months later by concessions on the part of the Rockingham Ministry, through which the legislative independence of Ireland was secured. Grattan received a grant of £50,000 from the Irish Parliament, but Flood and his adherents were dissatisfied with the character of the surrender, and a very bitter feeling was engendered between the two leaders. "Grattan's Parliament" did not realise the aspirations of its author, owing to its unrepresentative character and the corruption rife among its members, yet he gave but a cold support to Flood's agitation for parliamentary reform, confining his own efforts, for the most part, to the struggle for Catholic Emancipation. However, he brought forward a Place and Pension Bill, a bill debarring revenue officials from voting at elections, and others of the same character, but they were all thrown out. A bill, introduced by Secretary Orde, establishing complete freedom of trade, was passed by the Irish Parliament, but in the English House of Commons its operation was limited by the enforcement of the Navigation Laws in Ireland and other restrictions which were very distasteful to Grattan and his compatriots. Pitt was accordingly obliged to abandon the project. Just before the rebellion of 1798 broke out Grattan retired from public life, but in 1800 he returned as member for Wicklow, and resolutely opposed the bill for the Union. After it was passed he again withdrew from politics, but

in 1805 he was returned to the Imperial Parliament as member for Malton in Yorkshire, and in 1806 became member for Dublin. The rest of his life was devoted to the cause of Catholic Emancipation, his support of which was none the less keen because he himself was a Protestant. His death occurred in 1820. He was buried in Westminster Abbey, by the side of his friend Fox. The private and public character of Grattan were alike free from reproach, and his parliamentary eloquence entitles him to rank among the foremost orators of the age.

Gratz, or GRAZ, the capital of Styria in Austria, is picturesquely situated on the river Mur, 141 miles S.S.W. of Vienna by rail. On a steep hill in the centre of the town stand the remains of the citadel, which was destroyed by the French in 1809. Within the town there are many ancient buildings, including a cathedral which dates from 1462, the castle of the Dukes of Styria, the Landhaus where the nobles of the Duchy assembled, and a university, founded in 1586, which has a library of 120,000 volumes. The Johanneum, or technical school, was established in 1812. The chief industry is the manufacture of steel and iron goods; wine, sugar, and perfumery are also articles of trade.

Gravel. [CALCULUS.]

Gravel, an uncemented fragmentary rock made up of subangular water-worn fragments, generally siliceous and often mixed with sand, and stained of a yellow-brown by iron-oxide. Gravels may be of marine origin, but have then generally a more rounded character and pass into shingle (q.v.), or may be the marine matter of a glacier (q.v.) as in eskers; but most gravels are formed by rivers and are of modern (Pleistocene) age. Owing to successive diminutions in the streams, accompanied apparently with an intermittent uprise of the land, these gravels and other alluvial deposits have frequently been cut into terraces by the rivers. [RIVER-TERRACES.] Of these there are in Britain generally three, known as the High-level, Middle-terrace, and Low-level gravels, of which the lowest belongs to the Historical period, whilst the others contain pre-historic remains.

Gravelines, a small French seaport, in the department of the Nord, 13 miles E.N.E. of Calais. The population is rapidly diminishing. The French army was here defeated by the Flemish under Count d'Egmont in 1558. The town was fortified by Vauban.

Graves, THOMAS GRAVES, first LORD, a distinguished British admiral, was second son of Rear-Admiral Thomas Graves, of Thancks, Cornwall, and was born in 1725. He served under his father at the attack on Cartagena by Admiral Vernon, and in the *Romney*, 50, in the action of February 1743, as well as in Anson's victory and Hawke's victory in 1747. Promoted to be captain in 1755, he acted with vigour against the privateers until he was made Governor of Newfoundland, in which position he drove off the French under M. de Ternay. In 1779 he reached flag-rank, and in 1781

fought a gallant but indecisive action with the Comte de Grasse in Lynn Haven Bay. On his way home, in the following year, his flagship, the *Ramillies*, 74, suffered so severely that she had to be abandoned and destroyed, and several other vessels of the fleet were lost, owing to the frightful nature of the weather encountered. He was afterwards port-admiral at Portsmouth, and in 1794, under Earl Howe, was second in command at the great victory of June 1st, and was severely wounded. He was rewarded with an Irish peerage. He died an Admiral of the White in 1802.

Graves' Disease. BASEDOW'S DISEASE, EXOPHTHALMIC GOITRE (Gk. *ex*, out, *ophthalmos*, eye), a disease of which palpitation, enlargement of the thyroid gland, and protrusion of the eyeballs are the associated characteristic symptoms. This malady usually occurs in young adult women. Its cause is obscure, but is supposed to be in some way connected with disease of the cervical sympathetic nerves. The first symptom to appear is usually palpitation. As a rule, the prominence of the eyeballs is noticed before the enlargement of the thyroid gland. The disease is not uncommonly accompanied by morbid structural changes in the valves of the heart. Exophthalmic goitre is not in itself, as a rule, a fatal malady.

Gravesend, a port and borough in Kent, on the south side of the Thames, 24 miles E.S.E. of London. It consists of an old and a new town, the latter of which contains some handsome buildings. Market-gardens abound in the neighbourhood, and the inhabitants are much engaged in fishing, ship-building, and the supply of ships' stores. Gravesend is a favourite resort of Londoners during the summer season. It is mentioned as a harbour in Domesday, and was incorporated under Elizabeth. It now returns one member to Parliament. Pop. (1901), 27,175.

Gravière, JEAN PIERRE EDMOND JURIEN DE LA, French seaman and historian, was born at Brest in 1812, entered the navy in 1828, and became a captain in 1850, a rear-admiral in 1855, and a vice-admiral in 1862. Besides seeing some war service, he was for many years vice-president of the Higher Commission of Naval Archives. His leanings, indeed, were chiefly historical, and his works on naval history gained him election in 1888 to the Académie Française. He died in 1892. *

Gravimetric Analysis. Quantitative analysis—i.e. the determination of the amounts of the several known constituents present in a compound substance or mixture of substances—may be divided into two great branches, volumetric and gravimetric analysis. In the latter the determination is made by converting the particular constituent which is to be determined into some form of combination, the composition of which is accurately known, which can be obtained pure from the original substance, and the weight of which can be accurately determined. Thus, suppose it were required to determine the quantity of e.g. sulphuric acid combined with metals in a sulphate, a known weight of the substance would be dissolved in dilute hydrochloric acid and a solution of

barium chloride, BaCl_2 , added. By this means a white precipitate of sulphate of barium is obtained, which can be collected on a filter paper, dried, and heated strongly, so that no moisture remains, and the paper is completely burnt. As the resulting mass contains 41·2 per cent. of SO_4 , or corresponds to 42·1 per cent. of sulphuric acid, the quantity of this acid in the original body is easily determined.

Gravina, FREDERICO DE, Spanish admiral, was born in 1747. After much honourable service he attained flag-rank, and in 1793 co-operated with the English in the operations against Toulon, where he was wounded. In 1797 he was in command of a division at Cadiz when that place was bombarded by Nelson, and in 1805 he was deputed to conclude in Paris the secret treaty which led to the junction of the Spanish and French fleets in that year. He commanded in the consequent action with Sir Robert Calder, and was in command of the Spanish contingent at the battle of Trafalgar, where he received a wound of which he died in the following year.

Gravitation. From the earliest infancy of mankind and man the existence of an attraction of all bodies towards the earth has been experienced. The mode of action of this force was first stated by Newton, who enunciated the law of gravitation, that "every particle of matter in the universe attracts every other particle with a force in the direction of a straight line joining the two, whose magnitude is proportional to the product of the masses, and inversely proportional to the square of the distance between them." In more recent times it has been shown that similar laws hold for the attraction of unlike magnetic poles and for quantities of opposite kinds of electricity. Newton was enabled by his hypothesis to explain the motions of the moon round the earth and of the various planets round the sun. Given a planet moving in a definite direction at a certain instant, its motion relatively to the sun may be proved to be in an ellipse with the sun at one focus, if the mutual gravitational force between them be inversely proportional to the square of their distances apart. This is the first of Kepler's laws of planetary motion, which were deduced from observation by that astronomer before Newton's law had been formulated. Kepler's second law states that the line joining the sun and any planet sweeps out equal areas in equal intervals of time. This is not an experimental proof of Newton's law of inverse squares, for it holds good whenever the attraction is towards a fixed centre, whatever variation there may be in the intensity of that attraction. The third law is that the square of the periodic time or the time taken for the planet to complete a revolution round the sun is proportional to the cube of the major axis of the ellipse, and this again depends upon the accuracy of Newton's hypothesis.

Kepler's laws are only approximately true. The heavenly bodies are subject to certain perturbations which have been accurately measured, and which have been shown to be caused by the small gravitational forces existing between each body and the others. It was by means of such observed

irregularities in the motion of Uranus that Adams proved the existence of another planet still farther distant from the sun, and also calculated its position. Attention being directed to that portion of the heavens, Neptune was discovered, and another experimental proof of Newton's law of gravitation added to the many already existing.

A homogeneous sphere of matter will attract any external particle with a resultant force acting through the centre of the sphere, identical with that which would act on it if all the mass of the sphere were concentrated at its centre. If the sphere acts, not on a single particle, but on any irregular mass of particles, inasmuch as the force on each particle acts through the centre of the sphere the resultant force will also pass through the centre. So also will act a hollow sphere if perfectly homogeneous, whatever be its density, and hence also a sphere whose density is uniform at all points equidistant from the centre, for such a sphere may be regarded as being built up of concentric homogeneous layers. The earth approximately satisfies this condition, for, although it is not of equal density throughout its mass, its density is approximately uniform at equal distances from its centre. Hence the earth attracts all external bodies with a force of gravity passing through its centre. If it act on another sphere satisfying the same conditions the mutual force of gravity would be along the line joining the two centres, and will be identical with the force that would act between two particles placed at those two centres, whose masses are those of the earth and of the external body. Most of the heavenly bodies satisfy approximately this condition, and the calculations of gravitational effects are much simplified by the assumption of its correctness. Yet it must be remembered that the earth is, strictly speaking, a spheroid, and the irregularity of the attraction of the sun and moon on account of this eccentricity from the perfect sphere gives rise to the phenomena of *precession* (q.v.) and *nutation* (q.v.). With all small bodies there is a fixed point through which the force of gravity passes whatever be the aspect of the body towards the earth. This point is called its *centre of gravity* (q.v.), but, strictly speaking, there is no fixed point in any irregularly-shaped body that can properly be called its centre of gravity, such a point existing only for certain symmetrical distributions of matter that are termed *centrobaric*, an example of which is the homogeneous sphere just referred to.

The intensity of the force of gravity at any point is measured by the acceleration produced on any body free to move under the action of that force only. If the mass be increased the total force of gravity is proportionately increased, and the acceleration produced is the same. It is therefore independent of the mass of the body, and a piece of lead of any mass would have the same acceleration as a feather of any mass. Air-friction is observed to retard the one more than the other, but it is assumed above that the force of gravity shall be the only one acting, and the accelerations must therefore be observed in *vacuo*. But for accurate estimations it is desirable to use some indirect

means of measuring the intensity of gravity rather than of determining it by direct measurement of this acceleration. The periodic time of oscillation of a pendulum at any spot depends upon its dimensions and the intensity of the earth's gravitation (which is generally denoted g), and since pendulum experiments may be made with accuracy they are frequently employed in the determination of g .

The value of g in the British Islands is about 32·2 in foot-second units, i.e. a speed of 32·2 feet per second is acquired in a second. It varies from 32·091 at the equator to 32·255 at the poles, the body gaining weight as it moves from low to high latitudes. The value given for the equator is that of gravity diminished by the centrifugal force which tends to throw the body outwards, but if the effects of centrifugal force are eliminated it will still be found that at the poles the attraction is greater, for the distance of the body from the centre of the earth is less there than at the equator.

Various theories have been put forward to account for gravitational attraction, the chief being due to Newton, Le Sage, Lord Kelvin, and Clerk Maxwell, but these are scarcely more than suggestions, and are all open to serious objections.

Gray, a French town, on the Saône, in the department of Haute-Saône. It preserves the remains of an ancient castle inhabited by the Dukes of Burgundy, and has a trade in corn, timber, and iron.

Gray, ASA (1810–1888), a distinguished American botanist, was born at Paris in the state of New York. He studied under Professor Torrey, and in 1842 was appointed Professor of Natural History at Harvard. In 1874 he became regent of the Smithsonian Institution. He was influential in introducing a more natural system of classification in the science of botany, and did much to extend the views of Darwin in America. His chief work was his *Genera Flora America Boreali-Orientalis Illustrata* (1848–50).

Gray, DAVID (1838–1861), a Scotch poet, born at Duntiblae, on the Luggie, near Glasgow. His father, a poor weaver, sent him to the university of Glasgow in the hope that he would enter the ministry; but Gray, feeling that literature was his true vocation, came to London with Robert Buchanan in 1860. In spite of the kindly encouragement of Monckton Milnes (afterwards Lord Houghton), he was bitterly disappointed at his ill success. Falling into a consumption, he returned to his parents' home near Kirkintilloch, where he died. His *Luggie and Other Poems* was published, with a memoir by James Hedderwick and a prefatory notice by Monckton Milnes, in 1862.

Gray, ELISHA (b. 1835), an American inventor, who introduced various improvements in the construction of the telephone and the multiplex telegraph. He died in 1901.

Gray, JOHN EDWARD (1800–1875), a naturalist, born at Walsall, was keeper of the zoological collections in the British Museum from 1840 to 1874. He drew up catalogues of these collections,

with valuable annotations, and published *Illustrations of Indian Zoology* (1830-35), and other works.

Gray, Thomas, was born at Cornhill on the 26th December, 1716. His father, a man of strange temper, refused to educate him, and he was sent by his mother to Eton, where he formed a lifelong friendship with Horace Walpole. He afterwards proceeded to Peterhouse, Cambridge, but left the University without a degree. He then travelled for two years on the Continent with Walpole, at the latter's expense. On his return he began to read for the Bar, but finding, when his father died, that the cost would embarrass his mother, he returned to Peterhouse in 1742, and ever afterwards led the life of a studious recluse. Earlier in the same year he paid his first visit to Stoke Pogis in Buckinghamshire, a place at which he settled his mother with two of her sisters, and which is associated with much of his poetry. At this time he wrote there his *Ode to Spring*, and the *Ode on a Distant Prospect of Eton College*, and began the *Elegy Written in a Country Churchyard*, which, probably retouched in 1749, was not finished until 1750, when he sent it to Walpole. It was published in the following year, and at once raised Gray to a foremost place among English poets. In his private life it brought him a friendship with Lady Cobham and her niece, Harriet Speed, but the conjectures of his friends that the younger lady would become his wife were not fulfilled. In 1756 a practical joke of some undergraduates caused him to remove from Peterhouse to Pembroke Hall, which he made his home for the rest of his life, with the exception of three years (1759-1762) which he spent in London in order to be near the British Museum. In 1757 he published two odes in imitation of Pindar, *The Progress of Poetry* and *The Bard*, which marked an important step in the development of English lyrical poetry. At the end of this year, on the death of Cibber, he was offered the laureateship, which he declined. His last publication was in 1768, when he brought out some paraphrases from Icelandic and Gaelic sources. In the same year he was appointed Professor of Modern Literature and Modern Languages at Cambridge. His health, however, always weak, soon gave way, and he died on the 30th July, 1771.

The true biography of Gray is in his letters. They show playful gleams of the brightest fancy, a warmth of affection for his dearest friends, a student's interest in literature, and a love for nature, which, on the one hand, led him to fill his window-seat with mignonette, and, on the other, to anticipate the feeling of the 19th century for the grander aspects of mountain scenery. They afford an insight into the slow working of a genius which sought perfection of form in its slightest utterance, and they reveal an industry and a lack of ambition which make his story a record of abandoned projects. As much a scholar as a poet, he prepared the greater part of editions, which never saw the light, of Strabo, Plato, and the Greek Anthology, and of a History of English Poetry, while he left unfinished fragments of a Latin poem on the philosophy of Looke, and of one in English on *The Alliance of*

Education and Government. It may, however, be said that, in whatever he finished, he attained the perfection which he sought. In a certain profound melancholy and depth of insight he stood nearer to the present generation than to his own; but, except for his *Elegy*, he is not likely ever to be popular. He is the poet of the poet and the scholar, not of the man of the street.

Grayling, any fish of the genus *Thymallus*, with five species from the northern rivers of both hemispheres, chiefly distinguished from *Coregonus* (q.v.) by their long many-rayed dorsal, violet in colour with dark spots. *T. vulgaris*, the European grayling, is British; large specimens attain a length of ten inches. The general colour is silvery grey, with dark stripes from head to tail. *T. signifer* is known in Canada as *poisson bleu* (= blue-fish).

Grayling (*Hipparchia semele*, Linn.), a large English butterfly about $2\frac{1}{2}$ inches in expanse of wing, which is common on hill-sides and heaths in limestone districts.

Grease consists of a very impure mixture of fatty and oily matters, with a consistency somewhat like that of butter. It is largely employed as a lubricant for heavy machinery and axles of wheels, but is not employed for any delicate machinery.

Great Basin, a desert plateau in the west of the United States, comprising most of Nevada and part of Utah, California, Oregon, and Idaho. It is triangular, the northern boundary, 500 miles in length, forming the base, and the Wahsatch Mountains and the Sierra Nevada skirting the eastern and western sides respectively. The distance from north to south is about 800 miles. It is crossed by several mountain ranges, and abounds in streams, most of which flow either into the Great Salt Lake or into Carson Lake. These and the other salt lakes on the plateau are either evaporated or lost in the sand. There is little vegetation.

Great Circle of a sphere is a curve determined on its surface by any plane passing through its centre. It is the greatest circle that can be drawn on the surface of the sphere; all others are similarly produced by plane sections, but are of smaller size. The shortest line drawn along the surface connecting any two points on it is an arc of the great circle passing through them. Hence the importance of great circle sailing in navigation. [SPHERE.]

Great Fish River. (1) A river in Cape Colony, which rises in the Sneeuberg Mountains. (2) A river of British North America, known also as the Back River, which flows into the Arctic Ocean.

Great Kanawha, a tributary of the Ohio, which rises in the Blue Ridge in North Carolina.

Great Powers, the greater civilised States, usually applied to England, France, the German and Austrian Empires, Italy, Russia, and (sometimes) Spain. The United States doubtless deserves inclusion, but hitherto has taken little part in European politics. The phrase is usually applied in connection with the Eastern Question (q.v.).

Greatrakes, VALENTINE (b. 1628), was born at Lismore in Ireland. Soon after the Restoration he began to touch for the "king's evil," ague, and other maladies. Robert Boyle, Henry More, and others testified to the genuineness of his cures. He professed to be divinely gifted.

Great Salt Lake, in Utah, extends along the western side of the Wahsatch Mountains. It is about 80 miles in length, from 20 to 32 in breadth, and is 4,200 feet above the sea-level. It is very shallow and is destitute of fish, but contains insects of various kinds. There are several islands in the lake, one of which, Antelope Island, has a length of 18 miles. The lake has several tributaries but no outlet, the waters disappearing through evaporation.

Grebe, any bird of the cosmopolitan genus *Podiceps*, with 26 species, the type of a family *Podicipedidae*. Grebes are diving birds that frequent fresh water during the greater part of the year, only resorting to the sea in winter, and rarely going far from water, for the lobed feet are placed so far back as to be poor organs of locomotion on land, though they are admirably fitted for swimming organs, and by their means alone these birds dive and move under water. The general plumage is blackish-brown above, and glossy white, tinged with rust-red or grey at the sides, beneath. There is generally some rust-red on the crest, which is less developed in the female than in her mate. The flesh is uneatable, but the skins are valuable for muffs and trimmings. The Great Crested Grebe (*P. cristatus*), about 21 inches long, is resident in many parts of Britain, but is not nearly so common as the Little Grebe or Dabchick (*P. fluvialis*), about 9 $\frac{1}{2}$ inches long, and without a crest. The Red-necked Grebe (*P. griseigena*), about 17 inches long, and the Horned or Scalvonian Grebe (*P. auritus*), are autumn and winter visitants, the latter chiefly to waters of the eastern counties. The Eared or Black-necked Grebe (*P. nigricollis*), our rarest visitor, comes in spring and summer.

Grebos (KREBOS), a Negro people of West Africa, whose territory lies on both sides of Cape Palmas, being coterminous on the west with the Segleo and Bitao (Grand and Little Sess), and on the east with the Nyambo district. The Grebos are the Fish Kru of English writers, and are closely related to the well-known Kroomen of the Guinea Coast. (Dr. Baikie, *Voyage up the Knvora*; Captain Allen, *Expedition to the Niger*, vol. i.)

Greece. Physical Features. This country, lying in lat. 35° 40' to 40° 10' N., and long. 18° 20' to 25° 50' E., has undergone many changes in extent. During the early period of its history its limits depended rather on the nationality of its people than on precise territorial divisions. The boundaries of the modern kingdom were fixed in 1832 by a treaty between Great Britain, France, Russia, and Turkey. On the north the line was drawn from the Gulf of Arta along the Othrys range to the Gulf of Volo. In 1864 Great Britain added the Ionian Islands, and in 1881, in consequence of a clause in the Treaty of Berlin (1878), some 5,000

square miles north of the boundary of 1832 were given over by Turkey. In 1897, after the war with Turkey, the Thessalian frontier was rectified and a portion of territory lost to Turkey. The new boundary runs in a S.W. direction from a point on the Gulf of Saloni κ . The area of the country is nearly 25,000 square miles, of which the surface is so completely intersected by mountains that it presents an unusual variety of climate, enabling a traveller, between the plains and high ground, to pass in a journey of fifty miles through the seasons of spring, summer, and winter. The sharp dividing-lines thus created between various districts have led to great differences in the character of the inhabitants, and were largely the cause of the disunion which was fatal to the country in the classical period. At the time of the Turkish dominion the mountains sheltered bands of "Klephs," half-patriots, half-brigands, and often the inlets and islands have sent out pirates to sweep the seas with organised fleets. None of the mountains are active volcanoes, and none are covered with perpetual snow, but many of them reach the height of seven or eight thousand feet. The rivers are short, rapid, and not navigable; marshes and small lakes are common, and there are hot springs at Thermopylae and other places, which are used for medicinal purposes. Among the minerals are gold in small quantities, silver, copper, coal, iron, lead, antimony, and manganese. Marbles of different classes are largely quarried.

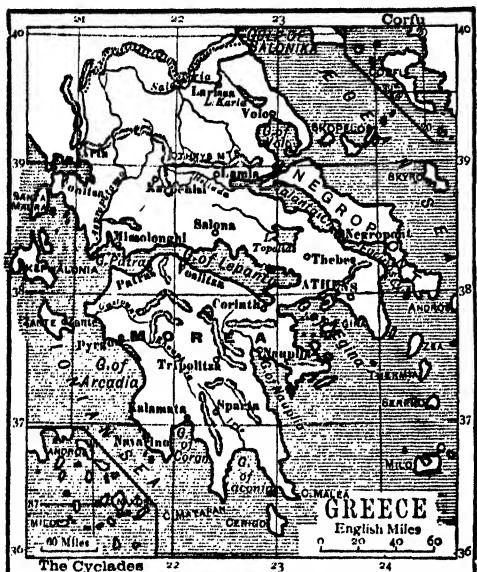
Productions. Exports and imports. Agriculture is backward. Much attention is paid to the cultivation and exportation of currants, oranges, lemons, almonds, pomegranates, wines, olive oil, and valonia bark. Silk, cotton, tobacco, and sponges are also exported. The chief imports are of cereals, cattle, and manufactured articles. The national finances are seriously embarrassed.

Army and Navy. Justice. The standing army consists of about 28,000, but all citizens are obliged to undergo training, and are liable for service up to the age of fifty. The navy contains only a few ironclads. In the administration of justice the jury system is adopted; the supreme court bears the classical name of the Areopagus.

Religion. In classical times paganism was the universal faith; to express doubt in it was to incur the enmity of the populace. Zeus was the highest god, but his will was subject to fate. Various deities had special worship in different places. The temple of Apollo at Delos was the centre of Ionic-speaking Greeks; his oracle at Delphi became a Panhellenic authority; Pallas Athene had Athens under her own protection. When Christianity swept away the old religion, a church grew up which supplied, to some extent, in its administration, the lack of political freedom. It became identified with the national life, so that to be a Greek has been for many centuries to be a member of the Greek Church (q.v.).

History. We have seen that the physical peculiarities of the country tended to make a number of independent communities. To such an extent was this the case that the city became the recognised political unit. The state, said Aristotle, would not be a state if it consisted "of ten men

or of ten times ten thousand." It must be of a moderate size, to allow the electors an acquaintance with the citizens whom they could choose for rulers, and the judges a knowledge of those whose causes they would have to decide. The origin of these tiny communities is lost in myth. In the imagination of the people the founders were heroes, the sons of gods, and legend took the place of record. Our earliest insight, not into events but into the state of society, is given by the Homeric poems. Each band of warriors had its king,



MAP OF GREECE.

practically supreme, but assisted by a council of elders and by an assembly of all his male subjects. These bodies were merely deliberative, and had little or no legislative power. Women, in later times kept in seclusion, then came freely forward. Hospitality was a cardinal virtue. Definite professions were already followed; a man was a bard, a leech, a carpenter, or a prophet.

Out of this society were developed the Hellenic States of history. In spite of differences, they were bound together internally by a fellowship in blood, in language, in habits, and in ways of thinking, and externally by common worship at certain shrines. To guard the temple of Apollo, who interpreted the will of Zeus at Delphi, an Amphictyonic league was formed. Twelve "races" of Hellenes sent representatives to its meetings, and during the early period its political influence was undoubtedly great. Other leagues, of less importance, among neighbouring cities acted also as unifying influences, but to a less degree than the great Panhellenic festivals of the Olympic, Isthmian, Pythian, and Nemean games, which afforded opportunities of friendly meeting even to members of belligerent states. The Olympic festival, held every four years,

formed a calendar of "Olympiads," of which the first was dated in 776 B.C.

Meanwhile Hellas was extending abroad. At an early date settlements of Doric, Ionic, and *Aeolic* Greeks had been made on the coast of Asia Minor and the adjacent islands, the first to the south, the second in the centre, and the third to the north. By about 700 B.C. Syracuse, Agrigentum, and other cities in Sicily were founded, and colonies from Tarentum round the coast to Cumae were laying the basis of a "Great Hellas," in Italy. In the east Byzantium was settled in 657 B.C., and within the next century towns from the Crimea to Spain and the coast of Africa seemed to be claiming a universal empire for the Hellenic name. Each colony went forth from "the mother city" under a leader, who bore with him fire from the public hearth. This filial tie was more than nominal. The appeal of a colony for help met with ready response, and probably nothing but the habit of quarrelling among themselves prevented the Hellenes from occupying much of the sovereignty reserved for the people of Rome. [COLONY.]

The tendency of the earlier Greek societies was to pass through oligarchy into democracy, and much of the internal politics of the various cities was concerned with the struggle for power between "the many" and "the few." The kingship was early abolished except at Sparta, and for a time (about 650-500 B.C.) we find in most cities a series of "tyrants" or citizens who acquired supreme authority, perhaps by means of the unpopular character of the ruling oligarchies. The permanent representative of the oligarchical principle was Sparta, which lay, securely girdled by mountains, a city or rather group of five "unwalled, unadorned, adjoining villages" in the Lacedæmonian plain. Its full citizens lived at a public table under a system of military drill. The constitution was ascribed to Lycurgus, of whom little or nothing is known. The two kings, whose hereditary title was never broken, were, in historical times, simply commanders in war. The real authority was with five ephors, elected yearly. There was a senate composed of the king and twenty-eight leading men, who must be at least sixty years of age. The proposals of this body were accepted or rejected by an assembly of the people, which had no power of initiative. The absence of free discussion may perhaps have prevented the development of literature and art, in both of which Sparta was deficient. The constitution, however, was the only one in an Hellenic city which had a long endurance.

Athens, the democratic rival of Sparta, at first substituted archons for the king. After a time there were nine of these magistrates, one of whom, "the Archon Eponymus," gave his name to his year of office, which thus served in the calculation of dates. At first the citizens belonged to four tribes, the subdivisions of which were based upon belief in the common divine ancestors of the various families. A good deal of discontent seems to have existed in early times, and in 624 B.C. Draco is said to have been ordered to codify the existing laws. The first legislative changes were made by Solon in 594.

He freed large numbers of debtors, and then reorganised the state as a timocracy, in which citizens were ranked in four classes according to their property. He also is said to have appointed a "probouleutic" or preconsidering senate of 400 members, to prepare measures for discussion in the assembly of the people, and to have enlarged the functions of the ancient senate of the Areopagus by giving it the censorship of morals.

In 560 B.C. Athens fell into the hands of a tyrant, Pisistratus, whose son Hippias succeeded him and was expelled in 510. The constitution, although turned to the advantage of the rulers, had been left unimpaired. It now received a democratic impulse from a noble, Clisthenes, who "took the people into partnership" and extended the franchise to resident aliens. To do this under the old system based upon religious ties was impossible; he, therefore, made ten new tribes, which he divided into demes or districts, arranging, in order to avoid dangers from the local strength of any division, that no two demes of the same tribe should be next to each other. He enlarged the senate, making each tribe contribute 50 to the new total of 500 members. From his time the movement in a democratic direction went steadily on. The lot was introduced into elections, and the citizens in their assembly of the Helizæa acquired judicial power and were divided into juries.

While the Athenian democracy thus began to take shape Hellas was approaching a great struggle with an external foe. The Persians had become masters of all Western Asia, when in 502 B.C. the Athenians and Eretrians went to the help of the Ionic colonists who were in revolt. The allies marched inland and burned Sardis, but the Persians soon reasserted their authority and planned a revenge in which they completely failed. In 490 B.C. 9,000 Athenians and 1,000 Plateans defeated their host at Marathon. Ten years later Leonidas, with 300 Spartans and 700 Thessalians, fell in the pass of Thermopylae, but the Persian fleet was destroyed at Salamis. In the next year, on the same day, their forces were defeated on land at Plataea and at sea at Mycale.

A danger, so narrowly escaped, left a sense of the need for united action, and the Athenians became the head of a league for the defence of the Aegean Sea called "The Confederacy of Delos." Little by little, however, they usurped power. They transferred the treasury from Delos to Athens, which rapidly assumed the position of a capital. At sea they defeated the Persians at the mouth of the Eurymedon in 466, and on land, ten years later, they humbled a league of Boeotian cities at Enophyta, and spread their supremacy northwards over Boeotia, Phocis, and Locris. Their dream of a land empire was brief. In 447 a defeat at Coronea compelled them to abandon Boeotia, just as they were about to pass, under Pericles, into the period of their greatest glory. This statesman curtailed the old aristocratic senate of the Areopagus, and ensured the better working of the jury system by payments to the jurymen. Not content, however, with completing the democratic movement by legislation, he strove to make the citizens worthy of their

place at the head of the Hellenic States. He spent the money of the allies in the decoration of Athens. He built the Parthenon, the Propylæa, and the Odeon. He gathered Phidias and other great artists round him. He distributed public money, that the poorest might enter the theatre and see the tragedies in which Æschylus, Sophocles, and other great dramatists taught the legendary care of the gods for the Hellenic world.

The position which Athens thus assumed caused great jealousy to the rival cities, particularly to those to whom the new democracy was, in itself, distasteful. As the result of Athenian interference in a quarrel between Corcyra and Corinth, Sparta, with most of the Peloponnesian States, the Peonian League, and Phocis and Locris, took the field in 431 B.C. against the Athenians and their subject allies. The course of the Peloponnesian War was marked by a succession of dramatic incidents—the plague at Athens, the destruction of Plataea by the Spartans, the capture from them of Sphacteria, the expedition to Syracuse, where in 413 the Athenian fleet was destroyed. In 405 the Spartan, Lysander, defeated another Athenian fleet at Agisopatami and blockaded the city, which was forced by famine to surrender. He set up Thirty Tyrants to rule in it, who acted with such cruelty that in 403 the democracy was restored, but the day of Athens was past.

Sparta then took the lead, and established oligarchic governments in all the subject cities. Fearful, however, of a new Hellenic power which might endanger their interests, the Persians stirred up strife among the various states, and were soon able to dictate the Peace of Antalcidas (387 B.C.), by which each city was to remain an independent unit. Sparta was thus deprived of the hope of empire, but Thebes soon came to the front under Epaminondas, who, in 371, defeated the Spartans at Leuctra. By arranging a league among the cities of Arcadia and making Messenia independent of Sparta, he altered the balance of power in the Peloponnesus, but his death at the battle of Mantinea in 362 led to the failure of his policy,

Ionian Athens, Doric Sparta, and Æolic Thebes had now failed to bring the cities of Hellas into lasting union, and lay, with all the other cities, weakened by strife, at the mercy of any powerful state which might attack them. Such a state arose in Macedonia, a country hitherto barely recognised as Hellenic. In a spirit prophetic of coming disaster the Athenian Demosthenes urged his fellow citizens to arm themselves against the king, Philip, who was beginning to interfere in Greece. The battle of Chaeronea (338 B.C.) placed Athens in his power. He then caused himself to be appointed commander of all the forces of Hellas, and organised an expedition against Persia. He was, however, murdered in the midst of his preparations, and left the last act in the two centuries of struggle against the Persians to his son Alexander, who in the battles of Granicus, Issus, and Arbela made himself master of the East as far as India. In Egypt he founded Alexandria, and in many other places settled Hellenic colonists, thus beginning a policy which was extended by the generals among whom, after his death, his dominions were divided. From this time dates the

new Hellenism of Egypt and the East, which produced the Hellenistic Greeks of the New Testament.

In Hellas itself confusion ensued, until, at last, two leagues, the Achæan and Aetolian, for a time maintained freedom, but a quarrel with Sparta and division among themselves, again brought the country under Macedonian influence, which only ceased when, in 146 B.C., it became the Roman province of Achæa.

Under the Romans Greece was at first treated fairly well, and much of the old municipal life was left. Hellenic culture fascinated the conquerors. Greek teachers poured into Rome, and Athens became the university for wealthy Roman youths. Little by little, however, the government became more oppressive. In the Mithradatic War the Greeks rose in a revolt which led to a devastating march of Sulla across the country and to the storming of Athens and the massacre of its inhabitants. Greece was then exposed to the exactions of the Roman officials on the one hand, and to the ravages of pirates on the other. In 267 B.C. the Goths swept across the land, destroyed many towns, and captured Athens, from which they were dislodged by the forces of the historian Dexippus.

In internal affairs the tendency during the following centuries was to more and more centralised rule on the part of the Romans. The Emperor Hadrian attempted to improve the condition of the Greeks by giving them rights equal to those of Roman citizens, by reforming the administration of justice, and by paying attention to roads and buildings. Constantine, the first Christian Emperor, took the important step of changing the capital from Rome to Byzantium, which he solemnly dedicated in 333 A.D. and called, after himself, Constantinople. The Emperor, having been the political head of the pagan religion, naturally assumed the same direction of the Christian faith, and, in the opposition of the orthodox Church to the Arianism, of the first Christian Emperors the people found a vent for the national feeling which chafed against the despotism of an alien court. Theodosius the Great (378-395) first established Christianity as the religion of the state. His sons, Arcadius and Honorius divided the Roman dominions between themselves, and Constantinople became the capital only of the Eastern Empire. At this time a great danger threatened Greece from Alaric and his Goths, but barbarians came and went; the centralisation of power in the hands of the Emperor remained and increased. Administration was portioned out among an army of officials, and "the people," says an historian, "had no position in the state but that of tax-payers."

This system of bureaucracy reached its full development under Justinian (527-565 A.D.), whose reign was also marked by the closing, in 529, of the philosophical schools of Athens. In the following century the empire began to be threatened by the Saracens, who rapidly spread westwards; and, little by little, as its extent was narrowed to Greece and the surrounding districts, it lost its Roman character and became what is known as the "Byzantine Empire." Under the Iconoclast Emperors in the eighth and ninth centuries a fierce struggle raged

in the Church about the worship of images, but petty as were its theological interests, the empire performed an important service in stemming the course of Saracen conquest. Internally the administration was good enough to permit a flourishing commerce. Trade, however, suffered seriously in the eastward rush of the Crusades, and the most important industry, the production, weaving, and dyeing of silk, was ruined in 1146 by the Norman, Roger, who transferred most of the artisans to Palermo. In 1204 the Crusaders and Venetians captured Constantinople, and divided the Empire—an act which has been taken as the end of "the Byzantine phase of the Eastern Empire." Baldwin, Count of Flanders, was elected Emperor of Romania, and reigned at Constantinople. Many new states sprang out of the partition, and new empires were founded at Nicæa, Trebizond, and Thessalonica. The feudal system was established in Greece. Athens became a fief of Romania, governed by dukes; a great part of the Peloponnesus was kept first by Franks and then by Neapolitans, as the Principality of Achæa. The Venetians obtained possession of most of the islands.

Of all the confused and crowded events of these times probably the most important was the capture of Constantinople in 1261 by Michael Palæologus, Emperor of Nicæa, but no attempt to hold Greece could long endure in the face of the Ottoman Turks who soon began to threaten from the East. In 1453 the Sultan Mohammed II. took Constantinople. The Venetians finally surrendered all claim to most of their Greek possessions by the Treaty of Passarowitz in 1718.

During the rule of the Turks the Greeks endured many hardships, including a curious tribute of children, who were educated by Mohammedans and trained for service in the corps of Janissaries. It was, however, to the interest of the Sultans for the sake of their revenues to encourage Greek commerce, and so there were wealthy classes with culture enough to make a fruitful soil for the teaching of the French Revolution. The spirit thus implanted led to the War of Independence in 1821—memorable for the generous sympathy of Byron, for the long siege of Missolonghi, and for the accident which led to the defeat of the Turkish fleet at Navarino in 1827 by English, French, and Russian vessels. In 1832 Otho of Bavaria was made King of Greece, but his rule was unsuccessful, and he resigned in 1862. The crown was then offered by the Greeks to Prince Alfred of England, who was prevented from taking it by a previous engagement between the great Powers. It was afterwards bestowed on a son of the King of Denmark, who now reigns as George I., King of the Hellenes. In 1896, as a consequence of the Armenian and Cretan troubles, a war broke out between Greece and Turkey, in which Greece was totally defeated, and compelled to resign her interests to the Great Powers. A rectification of the frontier resulted, and the payment of a large indemnity to Turkey.

Present Constitution. Legislation is in the hands of the king and of a parliament of one Chamber

bearing the time-honoured name Boulé. Its members are elected by universal manhood suffrage, are paid during their tenure of office, and sit for four years. To the Boulé the ministers are responsible, and for local government the country is divided into nomarchies, eparchies, and demarchies.

Language. [THRACO-HELLENIC.]

Literature. Each of three divisions of the Hellenic people, Ionic, Doric, and Æolic, had its own dialect, and has left its own literary record, although the masterpieces of the great Athenian authors were written in a fourth kind of Greek, Attic, the final perfection of Ionic. The earliest writings which we possess are the Homeric poems, composed in Asia Minor some time before the first authentic chronology begins. Beyond the facts that their finished execution presupposes a still earlier development of literature, and that they were composed in the Ionic form of speech with a certain admixture of Æolic, we know little of their history. Nothing at all is known of the author; it is even doubtful if the same origin can be assigned to the *Iliad*, which tells the siege of Troy, and to the *Odyssey*, which deals with the adventures of Odysseus on his homeward way. The grammarians of Alexandria were divided in opinion, some holding that one poet composed both poems, others, the "Chorizontes," that the differences between them are so great as to involve two authors. A century ago Wolf turned the controversy in a new direction by attempting to divide the *Iliad* into a number of separate lays, and since his time criticism has been incessant upon the poems. The so-called Homeric *Hymns* are later compositions, which formed the prelude to public recitations from Homer. The poems of the Epic Cycle, now lost, dealt with further legends arising out of the tale of Troy. The epics of Hesiod are of a different class. *The Works and Days* give instruction upon farming, while *Theogony* treats the legendary history of the gods.

The first variation from epic poetry was the elegy, an expression of the poet's feeling on the current topics of the day. Its earliest composer, Callinus (about 690 B.C.), like many other early poets, was an inhabitant of Asia Minor. He was followed by Tyrtaeus, Solon, Theognis, the poet-philosopher Xenophanes, and Simonides of Ceos. Iambic verse arose in the satire of Archilochus and Simonides of Amorgos. Lyrical poetry had a high development in the Æolic Greek of Alceus and the poetess Sappho, in the Ionic of Anacreon, and the Doric of Pindar, whose *Epinicia* or *Songs of Victory* we are fortunate enough to possess. They were written to celebrate success in the Olympic and other games, and blend, in sublime strains, the history of the victor with the legendary glories of his family. Doric lyrics took also a form which connected them with the stage. From the dithyramb, or choric dance and song in honour of the god Dionysus, arose in the hands of Alcman, Arion, and Stesichorus a new form of the chorus, to be the basis of the Attic drama of the fifth century before Christ, which, as has been well said, "combined the lyric and choric song with the living action of iambic dialogue, thus constituting the

last ascending movement in the poetic genius of the race."

Athens was the scene of the perfection of the drama, where plays were performed at the festivals of Dionysus. Tragedies, as a rule, were exhibited in sets of three, called "Trilogies," dealing often with the development of a single story, and the performance ended with a "Satyric Drama," in which the chorus was composed of those woodland companions of the wine god Dionysus, the satyrs. Tragedy was more than a mere acting of plays. It had a profound religious meaning. With Æschylus it taught a mythology of awe-inspiring grandeur, through which was wrought out the triumph of righteousness and vengeance upon crime. Sophocles, with much of the same religious spirit, treated the deepest affections of human nature, and showed their basis in the unwritten eternal laws of the universe. Euripides had a less lofty range, and was influenced by philosophical questionings which gave no trouble to the piety of the other two great authors, who with himself became the representatives to future ages of the band of poets who contested with them for the prizes awarded by the state for tragedy, but whose works have perished. The period covered by their lives was that of the glory of Athens. Æschylus fought at Marathon, and Sophocles and Euripides died within the year before the ruin of Athenian supremacy at Agospotami.

Comedy was also acted at the Dionysiac festivals. The attacks made in it by Cratinus upon living men turned it into a political weapon. Aristophanes (448-380 B.C.) was the greatest master of this satirical comedy, which he directed with unsparing wit against demagogues and philosophers alike. Menander (342-291 B.C.), whose plays have not been preserved, was the great poet of the New Comedy. His plays were much imitated by the Roman dramatists.

Meanwhile a prose literature had developed. Herodotus (born 484 B.C.) wrote a history of the struggle with Persia, full of quaint personal observations made upon his extensive travels, and tracing the ways of divine retribution in a most dramatic manner. Thucydides (born 471), in his account of the Peloponnesian War, founded scientific history. He was followed by Xenophon, who wrote an account of the march of the 10,000 Greeks across Asia, a fanciful life of Cyrus, and a record of the sayings of his master in philosophy, Socrates, whose teaching was given in a finer literary form by Plato (429-387), who made it the vehicle of his own ideal system. Contemporary with him was Aristotle, who founded the school of the Peripatetics, just as Plato founded that of the Academy. Epicureanism, a later school, was founded by Epicurus (342-370), and Stoicism by Zeno (344-260 B.C.).

In both philosophy and history were traces of the direct oral expression which was necessary in communities whose centre was the market-place, and which led in Athens to a magnificent development of oratory. Of the ten Attic orators who were ranked apart, Demosthenes (384-322) was the greatest, whose enmity to the Macedonian rule cost him his life.

With the settlements founded by Alexander and

his successors the literature of research may be said to have begun, particularly at Alexandria, which, with its magnificent libraries, attracted scholars and men of science during many centuries, among them Euclid, who about 300 B.C. produced his immortal propositions. The only original work of this period which deserves notice was the bucolic poetry of Theocritus, Bion, and Moschus, which inspired the *Elegies* of Vergil, as well as the English pastorals, of which Milton's *Lycidas* and the *Adonais* of Shelley are the best examples.

The same characteristics are found in the Roman period. The wit, satire, and profanity of Lucian in the second century after Christ were almost the only effort of high genius amidst generations of painstaking erudition. Ptolemy, about the same time, taught a system of astronomy which endured until the time of Copernicus. Among historians may be mentioned Polybius, Diodorus Siculus, Josephus, Arrian, Appian, and the ecclesiastical writers, Eusebius, Socrates, and Sozomen. Strabo and Pausanias wrote on geography. Plutarch composed biographies of lasting interest. In philosophy Epictetus, the freed slave, found a recorder of his teaching in Arrian; the Emperor Marcus Aurelius left deeply religious *Meditations*. In the third century a new mystic school arose, with the Neoplatonists, Plotinus, Porphyry, and Iamblichus, and, following the growth of the Canon of the New Testament, came a line of Christian teachers and theologians, among them Justin Martyr, Clement of Alexandria, Origen, Athanasius, Chrysostom, Gregory of Nazianzus, and Gregory of Nyssa.

Under the Byzantine Empire the drama flourished to some extent, and large numbers of histories were produced, of which only those of Procopius (500-565) had much literary merit. In the seventeenth century Vincenzo Cornaro wrote the *Erotocritus*, a love story, which ranks as the epic of modern Greece, and in the eighteenth the scholar Koraës, by his efforts to fix a pure standard, made himself the "legislator of the modern Greek language." The time of revolution had its poet, Rhegas, who was shot in 1798. Later came the great lyrical poet Christopoulos (1772-1847), the brothers Panagiotis and Alexander Sontzos, and Rhangabé, both novelist and poet. The language of the modern kingdom, although with certain alterations of inflexion, syntax, and vocabulary, is still derived from the speech of ancient Athens, and, by its present vigour, gives hope of an Hellenic future worthy of the great Hellenic past. [GREEK ARCHITECTURE, and also articles on SCULPTURE, PAINTING.]

Population. The Greeks are the most richly-endowed people of antiquity, forming the southern division of the Thraco-Hellenic branch of the Aryan-speaking populations, who are found from prehistoric times in joint and exclusive possession of the Balkan peninsula from the Danube to the Mediterranean and from the Adriatic to the Aegean Sea. In Greece proper the Thracian element was represented by the Pelasgians, who were the first possessors of the land and who were later absorbed by the Hellenic intruders from the north. The Pelasgians are sharply distinguished by Herodotus from the Greeks of history, whereas the two peoples are

identified by Dionysius, who declares that "the Pelasgian race is Hellenic." But there were clearly differences, which account for the two physical types recognised and perpetuated by Greek art and literature—the heroic, of ideal beauty, symmetrical figure of medium height, fair complexion, oval face, aquiline nose, small mouth and sharply-chiselled features, and the plebeian, of low stature, dark complexion, round face and less regular features. The languages also doubtless presented considerable diversity, to which was probably due the marked variety observable especially in the phonetic systems of the Hellenic dialects. The Greeks, so named by the Romans from an obscure semi-Pelasgian tribe with whom they first came in contact, originally comprised a large number of independent tribes, such as the Achaeans, Danae, Argives, Dolopes, Myrmidons, and many others, all of whom gradually accepted the collective name of HELLENES, that is, according to the Hellenic legend, descendants of Deucalion's son Hellen, whose two sons, Æolus and Dorus, and grandson, Ion, were supposed to be the progenitors of the ÆOLIANS, DORIANS, and IONIANS, the three main divisions of the Hellenic race. From the remotest times this race had already spread throughout the whole of Greece proper, all the adjacent islands, the western shores of Asia Minor, Sicily, and a great part of Southern Italia, which thence took the name of *Magna Græcia*. Later numerous colonies were founded round the shores of the Black Sea, in Egypt (Naucratis), in Libya (Cyrenaica), and as far west as Southern Gaul (Massilia), and all these settlements maintained constant relations with the mother country. They formed with it the Greek world of antiquity, which was greatly enlarged and acquired more unity and amplitude by the conquests of Alexander the Great, after which Pergamus, Antioch, and Alexandria became great centres of Hellenic culture on the Asiatic and African continents. The Greeks excelled all peoples ancient and modern in the æsthetic sense, manifested in every branch of art and letters and characterised especially by an exquisite feeling for form combined with a repose and sobriety of treatment contrasting sharply with the exuberance of the "romantic" school. But Greek art had its limitations, as, for instance, in architecture, which never assimilated the arch; and it was, perhaps, somewhat deficient in depth and passion. The Greek character was also certainly deficient in the moral sense. How far the present inhabitants of Greece are the lineal descendants of the Hellenes is a question still much discussed by anthropologists. During the Roman occupation few Italian colonists settled in the country, which was already well peopled by a superior—at all events, a more intelligent and versatile—race. Hence these intruders were speedily Hellenised everywhere in Greece proper, and succeeded in retaining their Latin speech and culture only in the more barbaric northern regions, where they are still represented by the Kutzovlacks of the Pindus uplands and by the Roumanians of Moldavia and Wallachia beyond the confines of the Greek world. But Greece itself was overrun, wasted, and almost

depopulated in the sixth century by fierce Slavonic hordes, who settled in the country and for a time transformed it to a southern extension of the Slav domain. Even after their reduction by the Byzantine emperors (807) the Peloponnesus and adjacent districts were but slowly repopled by immigrants of mixed origin from the Archipelago and Asia Minor; peoples who no longer even called themselves Hellenes, but "Romans," and who no longer spoke the classic language of Hellas, but a degraded "Romaic" dialect. And this neo-Greek or Byzantine mixture, superimposed on a Slav substratum, was in its turn subjected in the tenth and eleventh centuries to Bulgarian and Uze invasions, in the fourteenth to the Frank occupation, then to the more permanent Venetian conquest on the coastlands and in the Ionian Islands, followed by the long struggles of Albanians, Serbs, and Turks for predominance in a ruined Greece, and by the continuous infiltrations from Albania down to the 19th century. Sixty years ago Attica was little more than an Albanian province and Athens an obscure Albanian village, and the present national costume throughout Greece is distinctly Albanian. Consequently the remarkable revival that has since taken place has largely consisted in a transformation of Albanian and other foreign elements, rather than in a restoration of the old Hellenic stock, which had perished everywhere on the mainland except in a few inaccessible upland districts, particularly in Laconia and the southernmost peninsulas. Nevertheless, these transformed elements, constituting, probably, nine-tenths of the present Greek nationality, are already largely imbued with the old Hellenic spirit, derived, so to say, from the very atmosphere of their hallowed surroundings. They are a brave, enterprising, and highly intelligent people, lovers of letters if not of art, passionately devoted to the education of their children, daring mariners and great traders, but also, like the Hellenes of classic times, somewhat frivolous and untrustworthy. The Greek traders bear an indifferent reputation for honesty throughout the Levant. (J. P. Fallmerayer, *Geschichte der Halbinsel Morea*, etc., Stuttgart, 1830, and numerous other writings dealing specially with Hellenic ethnology; G. Finlay, *Medieval Greece*; G. Nicolucci, *Sull' Antropologia della Grecia*, Naples, 1868.)

Greek Architecture. The only buildings of the ancient Greeks which are still preserved are their temples, for of their theatres little usually remains except the seats. The form of a Greek temple is usually oblong, but sometimes square. Oblong temples consist of a cell, which is the main part of the building, and a portico at one or both of the ends. They are of several kinds, which differ in the position and arrangement of the external columns. In the temple called *in antis* the front portico is formed by prolonging the side-walls of the cell, which end in antæ or pilasters, and between these there are two columns. The *prostylos* temple has four columns in front of the antæ, and none between them. In the *amphiprostylos* this arrangement is adopted at both ends. In the

peripteral there are rows of six columns at both ends, connected by a colonnade on either side. The *dipteral* had eight columns at the ends, and a double colonnade at the sides. Temples are also classified as *tetrastyle*, *hexastyle*, *octastyle*, and *decastyle*, according as to whether they have four, six, eight, or ten columns in the porticos. The triangular face over each portico, caused by the slope of the roof, is called the pediment. It corresponds to the Gothic gable, but has less acute an angle at the apex. The roof rests on a horizontal surface of stone supported by the columns, which is called the entablature, and consists of three parts, the lowest being termed the architrave, the central the frieze, and the moulded and projecting portion immediately below the roof of the cornice. All Greek columns have capitals (q.v.) surmounted by an abacus (q.v.), and all excepting the Doric have bases.

Greek architecture passed through three stages, which are distinguished by the different character of the "orders" peculiar to each. An order is defined by taking a single column together with the part of the entablature immediately above it. In consequence of this difference the three varieties are known as the Doric, Ionic, and Corinthian Orders.

The Doric Order. The earliest example of classical Greek architecture, as opposed to Pelasgic (q.v.), is the Doric temple at Corinth, which was probably built about 650 B.C. The resemblance of the column in this order to the pillars found in the rock-hewn tombs of Egypt shows that Doric architecture in its earliest form must have had an Egyptian origin. By the Greeks it was carried to a height of perfection which made it one of the noblest products of human art. Its most characteristic feature is its low and massive columns, from 4 to 6½ diameters in height. They are without bases, and slope inwards from the ground towards the capital, so as to produce an impression of strength and support. Each shaft has 20 flutings, which consist of hollows forming less than a semi-circle, and are divided by a sharp edge. The mouldings (q.v.) of the capital consist of a quirked ovolu immediately below the abacus, which is a plain square, and two or three small flat fillets called annulets separated by channels below the ovolu. There is a deep channel in the shaft of the column a little below its upper extremity, but the flutings are continued upwards as far as the capital. Between the architrave and the frieze there runs a fillet called the *tænia*.

The frieze is adorned with triglyphs, groups of three projecting vertical bands, which are separated by spaces termed metopes. Below each triglyph, underneath the *tænia*, there is a row of small ornaments called *guttae* ("drops"). The frieze is surmounted by a broad fillet, called the capital of the triglyphs. On the soffit of the cornice, above each metope and triglyph, there are flat blocks called mutules, which often have *guttae* on their under side. The pediments and sometimes the metopes are adorned with sculpture. The most beautiful example of this order is the Parthenon or temple of Athene at Athens (q.v.). Next to it

rank the Theseum at Athens and the temple of Zeus at Olympia. All these buildings belong to the age of Pericles, the most flourishing period of Greek art and literature.

The Ionic Order lacks the massive character of the Doric, but it is lighter and more graceful. Its most striking characteristic is the large spiral on the capital, which is called a volute. This and other features show that it was derived from Assyria. Each capital has four volutes immediately below the abacus, which present a flat surface on the two opposite sides. On the shaft, which is about nine diameters high, there are usually 24 flutings, separated by fillets, but sometimes they are plain. The chief moulding is the echinus (the name given to the ovolu when it is enriched with the "egg-and-anchor" or "egg-and-tooth" ornament), below which there is sometimes a necking with the "honeysuckle" (as in the Erechtheum), or some other pattern between the two annulets. The characteristic base of the order is that known as the "Attic base." The entablature is either plain or ornamented. There is often a row of dentels ("little teeth") on the bed-moulding of the cornice. The finest specimens of the Ionic order are the Erechtheum (built about 420 B.C.) and the temple of Nike Apteros at Athens. One of the porticos of the former displays a very remarkable feature, "Caryatides" (q.v.) or draped female figures being used in the place of columns. They show the same minute care in the details of their construction which characterises the buildings of the Doric period.

The Corinthian Order. The most ancient example of the Corinthian order—the most ornate of the three orders, in which Greek architecture appears in its decline—is the Choragic monument of Lysicrates at Athens (335 B.C.). The Temple of the Winds at Athens and that of Zeus Olympios at Athens are also examples of this order. The most characteristic feature is again the capital. Its bell-like form may have been adopted from Egypt, but it retains the Asiatic volutes. One of these is placed beneath each of the corners of the abacus, which in this order have a projecting form, owing to the hollowing of the sides. Corinthian capitals, however, exhibit considerable variety in the treatment of detail, and those in the Temple of the Winds differ entirely from any other Greek capitals. Generally smaller volutes are introduced between those at the corners, and these are sometimes made to interlace. Above them, at the inmost point in the recess of the abacus, there is a flower or some other ornament. The lower part of the capital is usually adorned with two rows of leaves, one above the other, the volutes rising out of the upper row. They represent the foliage of various plants, especially that of the acanthus, the imitation of which is one of the chief beauties of this order. The height of the whole column is about ten diameters. The entablature is usually much ornamented, and the architrave is divided into two or three stages. The cornice is enriched with dentels, and beneath its corona there are modillions—projecting brackets corresponding to the earlier mutules.

Greek Church. The separate existence of the Greek or Eastern Church dates from the eleventh century. The disputes which resulted in the division of the ancient Church into two sections arose from two causes: the opposite tendencies of Christianity in the East and in the West, and the aggressive policy of the Roman see. The Greek love of speculation, which prevailed in the eastern churches, led them to attach great importance to minute points of doctrine, whereas the western churches laid stress on the moral or practical side of Christianity and favoured a strict enforcement of clerical discipline. The removal of the seat of empire to Constantinople enabled the Bishops of Rome to arrogate many of the functions of the absent emperors, and, as their civil power increased, they began to claim supreme authority over the whole Church. The Greeks resisted the attempt to enforce clerical celibacy and other disciplinary regulations, but the matter which roused their keenest hostility was the insertion in the Creed of the words *Filioque* ("Who proceedeth from the Father and the Son") in support of the doctrine of the twofold procession of the Holy Ghost. The first open rupture occurred in 484, when the Patriarchs of Constantinople and Alexandria were excommunicated by the Pope. The struggle again became acute in the ninth century during the Photian controversy concerning the right of the Patriarch of Constantinople to the title "ecumenical" which had been conferred on them by the Emperor. The actual separation, however, did not take place till 1054, when the Patriarch Michael Cerularius was excommunicated by Leo IX. Several attempts were afterwards made to effect a reunion, but they all failed owing to the stubborn attitude of Rome on the question of papal supremacy. The last occurred in 1437, when the Emperor John Palaeologus, accompanied by the Patriarch, attended the council of Ferrara or Florence in the hope of obtaining assistance against the Turks. Since the fall of Constantinople (1453) no efforts have been made to unite the two Churches.

The doctrines of the Greek Church are based on the early traditions of the Church as well as the Scriptures, and great regard is paid to the teaching of St. John Chrysostom. Only the first seven councils are recognised. The seven sacraments are accepted, but the administration of them differs in many respects from the Roman. Thus infants are confirmed and receive the Communion, which is administered in both kinds, and unction is administered not to the dying alone but to all sick persons. Prayers are offered for the dead, and there is a belief in Purgatory; but the notions regarding it are vaguer than they are in the Roman Church. The Greek Church employs three separate terms to distinguish its attitude of reverence towards both the Virgin and the Saints from actual worship. Churches, as well as houses and streets, are decked with icons or pictures of the Virgin and Saints; but, excepting the crucifix, they contain no graven image. The ceremonial is even more sumptuous than that of the Roman Church, but instrumental music is not permitted. The congregation stand during the service with their faces

towards the East, except at Pentecost, when they kneel. The secular clergy are obliged to marry once, but a second marriage is forbidden. The number of monasteries and convents is very large. The chief are those at Mount Sinai, Jerusalem, and Mount Athos, to which all the others are affiliated. The Greek Church does not attempt to gain proselytes, and has never shown any tendency towards persecution. All members of the Church are allowed to read the Bible. Besides the orthodox Greek Church there are several Eastern Churches which owe their existence to early disputes on matters of doctrine. Members of these churches are regarded as sectarians by those belonging to the orthodox Church. [CHALDEANS, ARMENIANS, MONOPHYSITES.]

After the overthrow of the Eastern Empire the Greek Church became subject to the Turkish sultans. The relations between the Church and the Porte are still determined by an enactment of Mohammed II. prescribing the limits within which the Patriarchs were allowed to exercise ecclesiastical jurisdiction. The four Patriarchs of Constantinople, Antioch, Alexandria, and Jerusalem occupy an independent position within their respective dioceses, but they are all subject to the control of an ecumenical synod. A certain pre-eminence attaches to the Patriarchate of Constantinople on account of its having received the title of "ecumenical." The other Bishops are associated with the Patriarchs in the decision of questions relating to the doctrines and government of the Church. The Patriarchs are elected by the Bishops, but their appointment requires the sanction of the Porte.

The great majority of the orthodox Greeks belong to "national" churches, each of which is under a separate system of church government. The *Church of Russia* dates from the introduction of Christianity into that country in 988. The *Church of Georgia* was founded in the time of Constantine. The *Church of Greece*, the organisation of which is modelled on that of Russia, was established in 1833. The *Church of Servia* regained its early independence in 1830, when it severed its connection with the see of Carlowitz. The *Church of Roumania* separated from the Greek Church in 1861. The Bulgarians have also attempted to set up a national Church, in consequence of which their "exarchate" lies under a sentence of excommunication. The Church of the orthodox or "Byzantine" Greeks in the Austrian Empire is governed by the Archbishops of Carlowitz and Hermannstad, who are subject to the Austrian Government alone. There are eight bishops, six of whom have sees in Hungary and two in Croatia.

Several attempts have been made to establish closer relations between the Greek and the Reformed Churches. During recent years very friendly feelings have existed between the Anglican and Greek Churches, and members of the one often join in the sacraments and services of the other. There has been a Greek Church in England since the time of Charles II.

Outside the Greek Communion are the body of Christians termed "Uniates" or "United Greeks." Ever since the fall of the Eastern Empire the

Church of Rome has made strenuous efforts to win converts amongst members of the Greek Church, and its activity in this direction has increased since the Reformation. The "Unia" is an agreement by which the converts retain a certain amount of their own doctrines and ritual on condition that they acknowledge the supremacy of the Pope. They are most numerous in Southern Italy, Sicily, Austria, and Poland. The amount of liberty conceded to the various groups depends on the degree to which they have been able to maintain their independence in the face of Roman encroachments.

Greek Fire consists of a mixture of various highly inflammable substances, and was much used by the Greeks during the seventh and eighth centuries in warfare—the burning mixture being thrown in bombs at ships or poured from ladles, etc., or projected from long tubes upon the attacking parties. The exact composition is unknown, having been kept a close secret, but it seems to have consisted chiefly of naphtha mixed with sulphur, nitre, and bituminous substances.

Greeley, HORACE (1811-72), American journalist and politician, was the son of a small farmer at Amherst, New Hampshire. At the age of 15 he was apprenticed to a printer at East Poultney, Vermont. In 1834 he started a literary weekly paper entitled the *New Yorker*, and soon afterwards the *Log Cabin*, which was political. The *New York Tribune*, which he edited until his death, was established in 1841, while the *Log Cabin* and *New Yorker* became merged in the *Weekly Tribune*. The *Tribune* supported a protective tariff, advocated temperance and co-operation, and agitated for the abolition of slavery and capital punishment. In this paper Greeley showed considerable sympathy with the socialistic views of Fourier (q.v.). In 1848 he was elected to Congress. He was one of the earliest members of the Republican party, and was instrumental in securing the election of Lincoln (1860). His efforts to effect a reconciliation between North and South after the surrender of Lee made him very unpopular in the northern states. In 1872 he unsuccessfully opposed Grant for the presidency. He wrote *The American Conflict* (1864), and *Recollections of a Busy Life* (1869).

Greeley, ADOLPHUS WASHINGTON (b. 1844), American Arctic explorer, was born at Newburyport in Massachusetts. In 1881 he was appointed head of the American expedition to the north of Smith Sound, undertaken in accordance with the international scheme decided on at Hamburg in 1879. After undergoing terrible privations, the survivors were in 1884 rescued off Cape Sabine by Captain Schley. In 1886 Greeley published a narrative of the expedition, entitled *Three Years of Arctic Service*. In 1887 he became chief of the signal service.

Green, JOHN RICHARD (1837-83), historian, was born at Oxford, and received his education at Magdalen College school and Jesus College. After leaving the university he became curate and afterwards vicar of St. Philip's, Stepney. In the midst

of his labours among the East-end poor he found time to contribute historical articles to the *Saturday Review*. In 1868 he was appointed librarian at Lambeth, but an attack of consumption in the following year rendered him incapable of any but literary work. In spite of poverty, illness, and the discouraging advice of his friends, he laboured on at his *Short History of the English People*, which was published in 1874, and immediately established his fame. This work is even more remarkable for its insight into the social life of our forefathers than for its vivid narrative and its grasp of historical principles. *The Making of England* (1882) and the posthumous *Conquest of England* were to have formed part of a continuous history of England up to the Conquest, a project which was cut short by his death.

Green, Thomas Hill (1836-82), philosopher, was born at the rectory of Birkin in Yorkshire, and educated at Rugby and Balliol College, Oxford, of which he became a fellow in 1860. In 1877 he was appointed Whyte's Professor of Moral Philosophy. Green's influence at Oxford was due as much to his personal character as his philosophic teaching. The latter was based on the philosophy of Hegel, which was moulded by Green into a new and more practical form. He taught that all men should work together in the unity of the Divine Spirit, which realises itself in human action only in so far as each individual feels that his spiritual life is bound up with that of his fellows. Hence Green took a keen interest in popular education and other social questions. He was a prominent member of the Schools Inquiry Commission (1864-66), and bequeathed large sums for university education and higher education in large towns. His works include an introduction to Hume's *Treatise on Human Nature* (1874), two *Lay Sermons* (1878), and the posthumously published *Prolegomena to Ethics* (1883), and his collected essays, published with a memoir, as the *Works of T. H. Green* (1885-88).

Greenbacks, the name given to a class of inconverntible bank notes issued by the United States Government during the Civil War. They received their name from the colour printed on the backs. The term came to be used generally of the paper currency of the United States. Specie payments were resumed in 1879. The "Greenback" or "Independent Party" was formed in 1874 with the object of confining the currency to Greenbacks, for the farmers attributed their prosperity during the war to the frequent issues of these notes. Later it was represented by the "People's Party."

Greenbottle Fly (*Lucilia Casar*, Linn.), a common English fly, which lives on hedges, and is remarkable for the brilliancy of its golden green colour.

Greene, Nathaniel (1742-1786), American general, was born in Rhode Island. He was almost entirely self-educated. Although brought up as a Quaker, he enlisted in 1774, and in 1775 was made commander of the Rhode Island contingent to the revolutionary army. He distinguished himself at the battle of Brandywine, and in 1780 was placed

in command of the army of the south. He was at first unsuccessful in his operations against Cornwallis, who defeated him at Guilford Court House, and forced him to retire into South Carolina. From this base Greene opened up a new attack, reconquered Georgia and the greater part of South Carolina, and by his victory at Eutaw Springs practically decided the contest in the south. He was granted an estate in Georgia, where he died in 1786.

Greene, Robert (1560-92), an English dramatist, born at Norwich, was educated at St. John's College, Cambridge. After travelling in Spain and Italy he settled in London as a playwright, and shares with Marlowe the honour of laying the foundations of the English romantic drama. His best play was the comedy of *Friar Bacon and Friar Bungay*, first acted in 1592. His romances—from one of which, *Pandosto* (1588), Shakespeare derived the plot of the *Winter's Tale*—are generally dull and tedious, but they contain many beautiful lyrics. In his *Groat's Worth of Wit bought with a Million of Repentance*, published after his death by Henry Chettle, he attacked Marlowe and Shakespeare. Greene led a dissipated life, and died from the effects of a debauch. After his death appeared *The Repentance of Robert Greene*, in which he laments his own folly and vices.

Greenfinch, Green Linnet (*Ligurinus chloris*), a common British finch, distinguished from the true Linnet by its thicker bill. It is a common cage bird, living well in confinement, and readily imitating the notes of other birds. The adult male is about six inches long, with green plumage marked with grey and brown; the female is rather smaller and of duller coloration. They frequent orchards and gardens, feeding on insects, seeds, and fruit, and generally produce two broods in the year.

Greengage, a valued variety of the cultivated plum, introduced from France, where it is known as "la Reine Claude," by Sir Thomas Gage. So established is this race that it will reproduce itself by seed. Land in Kent planted with greengages is said to have yielded £100 an acre in one year.

Greenheart, one of the strongest, heaviest, and most durable of timbers, is the product of *Nectandra Hodiei*, a lauraceous tree, native of British Guiana, which grows to a height of 70 feet. Its grey bark, known as *Bebeuru*, contains the febrifuge alkaloid *bibirine* or *bebeerrine*, now known to be identical with buxine ($C_{18}H_{21}NO_4$), the chief ingredient of "Warburg's drops." The greenheart wood is used for keelsons, beams, and blocks in our dockyards, and is classed A 1 at Lloyd's, resisting the white ant and to some extent the shipworm.

Greenland, an island-continent, most of which is within the Arctic Circle. It is separated from North America by Davis Strait and Baffin Bay. Its nearest point is within ten miles of Grinnell Land. There are more than 3,000 miles of coast, intersected, especially on the west, by fiords like those of Norway, overhung by lofty cliffs. Petermann's

Peak, on the east coast, is 11,000 feet in height, and there are several other considerable elevations. Vast ice-fields stretch across the country, rising, about 30 miles inland towards the east, to a height of 9,000 feet. Though the cold is more extreme in the north, there is less snow than in the south; 68° is the highest recorded temperature, and -66° Fahr. has been experienced. The weather changes very rapidly from brilliant sunlight to thick fog. The chief animals are European, and include the wolf, dog, white and blue fox, white bear, walrus, musk ox, reindeer, Arctic hare, and several species of whales and seals. There are sixty-three kinds of birds, of which all but the raven, ptarmigan, owl, hawk, and some sea-birds are migratory. Eider-ducks are shot in great numbers, and large quantities of their eggs are taken. The inhabitants live largely upon the halibut and other fish; and some 200,000 cod are caught annually on the banks. Only in the south are there any trees. The trade of Greenland, except in the north and north-east, is a Danish monopoly, managed by two inspectors, responsible to the head of a board in Copenhagen. Danish ships arrive and carry away blubber between May and November. In the winter seals are killed. The inspectors are also magistrates, but there is very little crime. They are advised by local councils, but have absolute power.

Greenland was first visited about 986 by Eirikr the Red, an exile from Iceland, which is only about 100 miles distant. He settled where is now the Eskimo station, Igaliko. Bjarin, who followed, probably found the coast of America. Christianity was introduced in the 12th century; and in 1261 the Greenlanders swore allegiance to Hakon, King of Norway. From this time they began to be attacked by the Eskimo from the north, and after a time became extinct as a race. When Davis came from England in 1580 he found no inhabitants but the Eskimos. In 1721 Hans Egide, the missionary, came from Denmark, and from that year dates the civilisation of the Eskimos. In 1774 the Danish Government took over the trade, which was being abandoned. The country has been explored in recent times by Inglefield, Kane, Hayes, Hall, Nares, and Nansen; in 1869-70 a German expedition visited the east coast, and Mourier led a party there in 1879. Commodore Peary, of the U.S. navy, in 1898-1902 rounded its northern end. The aborigines of Greenland, are a branch of the Eskimo race, who call themselves *Kalalit*, "men." [ESKIMO.] They are the *Skrælingar* ("dwarfs") of the early Norse settlers, and this term is even still occasionally applied to them, though it has lost its original sinister meaning. The Kalalits are scattered in small groups along the west coast, far beyond the Danish colonies, traces of their camping grounds having been met by Captain Nares' expedition (1875-76) as far north as 82° N. lat. Even on the much colder east side they range up to 75° N.; but here they are far less numerous; and all the full blood and half-caste Eskimo of Greenland scarcely exceed 12,000 souls altogether. The nomad groups are still pagans, but those settled about the Danish

stations have been evangelised by Danish and Moravian missionaries since the eighteenth century. They are a gentle, peaceful race, but improvident, and of incurably filthy habits, though the offensive odour observed by all travellers is mainly due to their whale, seal and train-oil diet. Physically they differ from the western Eskimo, specially in the shape of the skull, which is highly dolichocephalic, more so than that of any other race except the Melanesians of Fiji and the New Hebrides. Their Eskimo dialect, which possesses translations of the Bible and other religious books, beside some national legends and folk-lore, is still universally spoken, though many understand Danish. (*Nansen, Rink, Le Grænland*, Copenhagen, 1852-57, and numerous other writings.)

Greenlaw's Process, a photographic process for obtaining a "positive" print upon paper, or it may be used for the production of negatives by waxing the paper after printing. The process is carried out in the following manner:—The paper is coated with a solution in water of potassium bromide and iodide, with some free iodine, and is then allowed to dry. It is next immersed in a solution of silver nitrate and acetic acid, being afterwards washed and dried. This is then placed in the camera or in the printing frame and exposed. After exposure it is developed by a strong solution of gallic acid with a little silver nitrate. It is next well washed and fixed by sodium hyposulphite. The process is more suitable for negatives than for positives, but is not of frequent usage among photographers at the present time.

Greenock, a town in Renfrewshire, Scotland, 22 miles west of Glasgow, is situated on the south bank of the Firth of Clyde. Behind the town is a ridge of hills 800 feet in height, from which there is a fine view. Two centuries ago Greenock was a fishing village, but since the middle of the 18th century it has steadily grown. Under charters granted at this time it had the most liberal municipal constitution of all Scottish burghs. At the Reform Bill it became a parliamentary borough, and continues to return one member. The harbour was constructed in 1710, and has since been greatly improved. The James Watt dock was finished in 1886. The commercial importance of Greenock dates from the Act of Union. Its trade was temporarily interrupted by the American War, but soon after the peace it gained great importance as a seat of the shipping trade. The chief of its other industries is sugar-refining. Greenock is connected with Glasgow by two lines of railway. Many passengers prefer to sail from it rather than from the larger port higher up the Clyde. It has a frequent service of steamers to Belfast, Dublin, and Liverpool. The water-supply of the town is derived from Loch Thern and Loch Gryfe, two large reservoirs behind the town, which also afford water-power to the mills. The chief institutions of Greenock are the Wood Mariners' Asylum for decayed seamen, and the public hospital and infirmary. There are two public parks, and a fine esplanade. The Watt monument contains a statue of James Watt by Chantrey, and a public library. (Pop. 67,645.)

Green Pigments, etc. [PIGMENTS.]

Green Salt, the first of a large number of ammoniacal platinum compounds, was obtained in 1828, and known as *Magnus Green Salt*. It is formed as a green insoluble powder by the action of platinous chloride, PtCl_2 , upon ammonia, and has the composition $\text{PtCl}_2(\text{NH}_3)_2$. From it a large number of other platin-ammonia compounds were afterwards prepared by the action of various acids and salts.

Greensand, a name applied to certain sandy beds belonging to the Cretaceous system (q.v.), as developed in the British Isles from the presence in them of grains of glauconite (q.v.), though the beds are often clays or limestones, and even more often not noticeably green. The marine beds that immediately overlie the Weald Clay, and are equivalent to the Upper Neocomian of the Continent, are known as the "Lower Greensand." Among their most characteristic fossils are *Perna Mulletii* and *Eurygyra sinuata*. They have been subdivided in the south-eastern counties into four series or phases :—

Folkestone beds, silver and iron-shot, sharp, current-bedded sands, 70 to 100 feet thick.

Sandgate beds, less pure sands, with fuller's-earth and chert bands 75 to 100 feet.

Hythe beds, dull and earthy buff and yellow sands with layers of sandstone in Surrey, passing into the Kentish Rag limestone and "hassock" or earthy sandstone in Kent, 80 to 300 feet.

Atherfield Clay, 20 to 60 feet thick. The Folkestone beds are overlaid by the Gault with some apparent unconformability, and only about 20 per cent. of the Lower Greensand fossils pass upward into the Upper Cretaceous.

The Lower Greensand has its most conspicuous development in a range of hills running through Kent and Surrey, S. of and parallel to the North Downs, and reaching in Leith Hill a height of nearly 1,000 feet.

The name "Upper Greensand" is applied to the often compact sandstone above the Gault, the base of the Cenomanian of the Continent. In Surrey it forms a narrow band, usually of a marly character, but occasionally a deep orange sand. It is well developed in East Devon, Somerset, Wilts, and N. Berks, forming two zones: the lower, or *Blackdown beds*, the zone of *Ammonites inflatus*; and the upper, or *Wormminster beds*, that of *Pecten asper*, *Holaster notulosus*, etc. To the latter belongs the Firestone of Merstham and Godstone, Surrey.

To a still higher level belongs the so-called "Cambridge Greensand," a layer of glauconitic marl containing erratics and phosphatic fossils derived from the Gault. It is probably on the same horizon as the "Chloritic Marl" and the Red Chalk of Hunstanton.

Greenshank (*Totanus glottis*), a common European sandpiper (q.v.), visiting Britain in spring and autumn, and occasionally breeding in the northern parts. The length is about 14 inches; the plumage shades of brown and grey, darker in the summer than in the winter, when the under surface

becomes quite white. These birds feed on insects, worms, and small molluscs. The popular name refers to the colour of the long legs.

Green Sickness. [CHLOROSIS.]

Greenstone, an obsolescent name, formerly applied to many diabases, diorites, dolerites, and probably other compact crystalline rocks, which, from the presence of hornblende, augite, or viridite resulting from the alteration of such magnesium silicates, have a greenish colour. It is a convenient term in field geology, pending further information.

Green Vitriol. [COPPERAS.]

Greenwich, a town in Kent, six miles S.E. of London by river, on the right bank of the Thames. In the reign of Æthelred II, the Danish fleet moored here. It had a royal residence, called Greenwich House, so early as the 13th century, which, after being granted to two great nobles, reverted to the crown on the death of the "good" Duke Humphrey of Gloucester in 1433. In this palace were born Henry VIII. and his two daughters. It was also much used as a residence by the earlier Stuarts, but was pulled down by Charles II., who began Greenwich Hospital, which was added to in the reigns of William III. and Anne by Inigo Jones and Wren. It was rebuilt in 1811, when a chapel was also erected. It was liberally endowed, and at one time accommodated 3,000 seamen, as well as giving out-door relief to some 5,000 more. In 1869, however, a system of pensions was substituted for the board and lodging; and since 1873 the buildings have been used as a Royal Naval College. There are numerous charitable institutions in Greenwich, among which may be mentioned Trinity Hospital, founded in 1613; Queen Elizabeth's College; the Jubilee Almshouse, founded in 1809 by the natives of the town; and the schools called the Orphan Girls', the Green Coat, and the Grey Coat. Greenwich Park, the area of which is nearly 200 acres, was laid out by Charles II., but was enclosed much earlier. From a hill towards the south a fine view of London may be obtained. The Royal Observatory, from the meridian of which longitude is reckoned, was built in 1675. The borough of Greenwich returned two burgesses in the reign of Elizabeth, but was unrepresented from 1577 till 1832. By the Reform Bill it was divided into three single-member districts. Pop. (1901), 95,620.

Greenwich Hospital. The Royal Hospital at Greenwich, built on the site of a royal palace, was founded by William and Mary in 1691 as a home for superannuated seamen and marines. These were formerly chosen by the Admiralty, and were lodged, victualled, and clothed by the Hospital, within or without its walls, as well as supplied with pocket-money; but since 1871 the pensioners have wholly ceased to reside on the spot, and the building has been devoted to the purposes of the Royal Naval College (for the technical instruction of officers) and of a naval museum and picture gallery. The pensioners numbered in 1708, 300; in 1728, 450; in 1738, 1,000; in 1751, 1,300; in 1782, 2,300; and in 1805, 2,410 in, and 3,234 out.

Greg. WILLIAM RATHBONE (1809-81), an able essayist, was born at Manchester. He gave up the business of a mill-owner in 1850, and next year published his *Creed of Christendom*. He subsequently contributed to the reviews, and published several other essays, which were collected in *Essays on Political and Social Science, Literary and Social Judgments* (4th edition, 1877), and *Miscellaneous Essays*. He was Comptroller of the Stationery Office from 1864 to 1877, and had previously held a commissionership of Customs. His son, PERCY (1836-1889), wrote novels (*Across the Zodiac*, etc.) and a strongly partisan *History of the United States to 1887*.

Gregarines, a sub-class of the Sporozoa (q.v.) containing a series of parasites. The body is rather complex for the Protozoa, it being divided into three segments, an epimerite, a protomerite, and a deutomerite; the last is the largest and most important, as it contains the nucleus (q.v.). All three segments are not always present; when they are the animal is said to be "Cephalont," but when the first is lost it is "Sporont." The body is composed of three layers, an external or "sarcocyte," an internal or "entocyte," and an intermediate fibrillar once known as the "myocyte." There is usually also a cuticle formed from the outermost layer of the sarcocyte. There are two main groups, the Monocystidea and the Polycystidea; the former live in ascidians, worms, etc., while the latter usually infest insects.

Grégoire, HENRI (1750-1831), a French priest who played a prominent and not dishonourable part in the Revolution, was born near Lunéville. Before the Revolution he had published several works, and was sent by the clergy of Nancy in 1789 to represent them in the States-General. He was one of the first four of his order who joined the Third Estate, and took an active part in the proceedings of the Constituent Assembly. He accepted the position of Bishop of Blois under the new Civil Constitution of the Church, but continued to sit in the Assembly. In the Convention he proposed the motion for the abolition of the monarchy, but opposed the execution of the king and the state renunciation of Christianity. It was on his motion also that the negroes in the West Indies were enfranchised. He showed himself superior to most of the leading revolutionists by doing all he could to restrain vandalism and to protect men of letters. He was a member of the Council of Five Hundred, and also of the Legislative Assembly constituted after the 18th Brumaire; and, although he voted against the Empire and the divorce of Josephine, he was created a Count and an officer of the Legion of Honour. In 1819 he made an attempt to re-enter political life, but his election was annulled. When he died the Church refused him her rites.

Gregorian Calendar. [CALENDAR.]

Gregorian Telescope is one type of reflecting instrument, the others being due to Newton, Cassegrain, and Herschel. In the Gregorian instrument rays of light are reflected back from the large

concave mirror, and after passing through the focus are again reversed in direction by a small concave mirror that brings them to a focus a short distance behind the great mirror, in the centre of which a small hole is cut to let them pass. An eye-piece is adjusted to receive them from this second focus and transmit them to the eye of the observer. The general disadvantages of this type of instrument are referred to in the article on telescopes.

Gregory I., called "the Great," Pope of Rome, was born towards the middle of the sixth century. Previous to the death of his father he took an active part in civil affairs, but at that period he gave up his property to pious uses, embraced the Benedictine rule, and passed his life in prayer and charitable works. He represented the Papacy at Constantinople for more than three years, and in 590, soon after his return, was chosen Pope, but did his utmost to avoid taking the office. His pontificate lasted fourteen years, during which order was restored in Rome, ecclesiastical discipline was strengthened in France and Italy, heresy was vigorously combated in Spain and Africa, and England was evangelised. Gregory died at Rome in 604. Numerous works are attributed to this Pope, who had a great dislike of all secular learning. The *Moralia*, an exposition of the Book of Job, and Homilies on the Gospels and Ezekiel are undoubtedly, but the work on the seven Penitential Psalms is almost certainly spurious.

Gregory VII., better known as HILDEBRAND, was born about 1015 at Saona in Tuscany, where his father is supposed to have been a carpenter. He passed his early years in a monastic house at Rome, and in 1046 became one of the chaplains to Gregory VI., whom he accompanied into exile in Germany. He next passed some time as a monk at Clugny. He persuaded Bruno, when elected Pope as Leo IX., to refrain from exercising his authority until he had not only received nomination from the Emperor but had also been elected and consecrated at Rome, and over his successors, Victor II., Stephen IX., Nicholas II., and Alexander II., his influence was unbounded, and he was himself Pope in all but name. At length in 1073, on the death of the last-named, he was persuaded to accept the tiara for himself, when he took the title of Gregory VII. in memory of his earliest friend. He immediately set himself to reform the Church from within and to protect it from without. Celibacy was restored and simony repressed, and in 1075 the Investiture struggle was initiated by a decree declaring any clerk who should receive office from lay hands liable to deposition and any layman who should presume to confer it subject to excommunication.

In 1076 the Emperor Henry IV. was cited to appear at Rome to answer charges of simony, sacrilege, and oppression; and when he replied by declaring Hildebrand deposed at the Diet of Worms the Pope rejoined by excommunicating him and the bishops who had attended. The German clergy now yielded, and Henry came and did penance at Canossa. Soon after this, however, he again defied Hildebrand, and, invading Italy in

1080, took Rome after a siege of more than three years, and set up Guibert as Pope Clement III. Hildebrand at first shut himself up in the Castle of St. Angelo, and even when Henry had to return to Germany dared not remain in Rome, where his strict rule had made many malcontents. He therefore fled to the protection of Robert Guiscard the Norman at Salerno, where he died a year later on May 25, 1085. Hildebrand was one of the greatest men of the Middle Ages. He not only laid the foundations of the temporal power of the Popes, but also rescued the Church from the stagnation into which it had fallen. Had he not made so firm a stand as he did for the rights of the spiritual power, it seems doubtful whether there would have been any refuge in the Dark Ages from the tyranny of arbitrary kings and feudal despots. Gregory VII. has had many biographers, Italian, French, and German. Villemain's *Histoire de Grégoire VII.* was translated in 1874.

Gregory IX., nephew of Innocent III., was elected Pope in 1227, and carried on a struggle with the Emperor Frederick II. as Gregory VII. had done with Henry IV. Frederick was first excommunicated for not going on crusade, and, having failed in his invasion of the Papal territories, was fain to ask absolution in 1230. Two years later the Pope was driven from Rome, and had to appeal to the Emperor for help. In 1239, however, their relations again became hostile, and a second sentence of excommunication was launched. War was still proceeding when Gregory died in 1240. This Pope was a personal friend of Francis of Assisi, whom he canonised together with Saint Elizabeth and Dominic. He was a learned lawyer, and caused the compilation of the *Decretals* in 1234. His attempts on the liberties of the English Church were more successful than his attacks on those of the French.

Gregory XIII. [CALENDAR.]

Gregory XVI. (CAPPELLARI), was born at Belluno in 1765. His name first became known in 1799, when he published his *Trionfo della Santa Sede* against the Italian Jansenists. After the return of Pius VII. to Rome he was made councillor of the Inquisition and Prefect of the Propaganda, and in 1825 was created Cardinal. In 1831 he succeeded Pius VIII. as Pope. In the course of a fifteen years' pontificate he opposed the spread of revolutionary ideas with much vigour, and was also charged with many acts of cruelty. He also began to develop Ultramontanism, which reached its high tide under his successor Pius IX., who was elected Pope on his death in 1846.

Gregory of Nazianzus, ST., a father of the Eastern Church, was born in Cappadocia about 330. While studying at Athens he became acquainted with Basil. After acting for some years as assistant to his father, who was Bishop of Nazianzus, he on his death in 374 retired to Seleucia. About 379, however, he was summoned to Constantinople to head the orthodox party there, and, having been a successful champion, was made

bishop with the sanction of Theodosius. His promotion, however, seems to have caused some jealousy, and he soon resigned and retired to Nazianzus, where he died about 390. He gained the surname of "Theologus" for his defence of the doctrine of the Trinity; and his invectives against Julian are well known. He was also an able letter-writer and a powerful orator.

Gregory of Nyssa, ST., a younger brother of St. Basil, was born about 330, and was ordained Bishop of Nyssa in Cappadocia about 372. He was deposed by Arian influence for three years, but returned in 378. In 381 at the Council of Constantinople he was an eloquent champion of orthodoxy, and the additions then made to the Nicene Creed are thought to have been due to him. Next year he visited Jerusalem, and in his letter *De Eundis Hierosolyma* condemned the practice of pilgrimage. In 385 he delivered the funeral orations of Pulcheria and the Empress Placilla. He died between 395 and 400. He was the author of numerous works, of which the chief were the *Treatise against Eunomius*, controversial works against the Arians, Manichaeans, and other heretics, and several expository and homiletical works.

Gregory of Tours, ST., author of a *History of the Franks*, was born at Clermont about 540. In 573 his own reputation as well as the position held by his family procured his election to the bishopric of Tours. The protection which he accorded to the victims of tyranny brought upon him the wrath of Fredegonde, but when charged by her with treason he was acquitted. In 581 he acted as mediator between Chilperic and Childebert, and as he grew older his political influence continued to increase. He died at Tours in 594. The *Historia Francorum*, of which there are ten books, is the earliest of French chronicles. It is utterly uncritical, but is valuable none the less as an honest record. Gregory also wrote a treatise, *De Miraculis*.

Gregory, the name of a Scotch family, the following members of which were eminent:—

1. JAMES (1638–1675), a mathematician, invented the reflecting telescope in 1661, which was in use for more than a century. He was a fellow of the Royal Society, and had much correspondence with Newton and Huygens, the latter of a hostile character. He also published several mathematical works, and was the first professor of the subject at Edinburgh University. He was struck blind by *amaurosis* while lecturing, and died of apoplexy three days later.

2. JOHN (1724–1773), his grandson, was son of James Gregory, professor of medicine at Aberdeen. He studied at Edinburgh and Leyden, and was for three years professor of philosophy at Aberdeen. In 1754 he became a fellow of the Royal Society, and, on the death of his elder brother James, succeeded him as professor of medicine at Aberdeen. He afterwards removed to Edinburgh, where in 1766 he was elected to the chair of practical physic. He was the author of *Elements of the Practice of Physic* (1772) and other works. John

Gregory, was intimate with Akenside, Hume, Lord Kaines, and James Beattie.

3. **JAMES** (1753-1821), the eldest son of John, was born at Aberdeen, and went with his father to Edinburgh in 1764. He studied medicine there and on the Continent, and in 1776 succeeded to his father's chair at Edinburgh. He was eminent alike as a professor and a practitioner, and his lectures on clinical medicine at the Royal Infirmary were always crowded.

4. **WILLIAM** (1803-1858), son of the last-named, a distinguished chemist, held professorships at Glasgow, Aberdeen, and Edinburgh successively. He translated several of Liebig's works, and was one of the first to propound his theories in England.

5. **DUNCAN FARQUHARSON** (1813-1844), another son of Dr. James, was one of the founders of the Chemical Society, and first editor of the *Cambridge Mathematical Journal*. His important mathematical writings were edited by W. Walton in 1865.

Gregory, OLINTHUS (1774-1841), was born at Yaxley, Hunts. At the age of nineteen he published *Lessons Astronomical and Philosophical*, and in 1802 a treatise on astronomy which made his name known. He had early made the acquaintance of Charles Hutton, whom in 1807 he succeeded in the mathematical chair at Woolwich. He is quite as well known by his biographies of Robert Hall and J. M. Good and his popular work on Christian evidences as by his scientific writings.

Greifswald, a town in the province of Pomerania, Prussia, 20 miles S.S.E. of Stralsund. It was founded in the 13th century by Dutch merchants, and in 1250 received a constitution from Duke Wratislaus. Soon after it formed a league with the Hanse Towns against Denmark and Norway. From 1631 till the Peace of Westphalia it was held by the Swedes, into whose possession it again twice fell, but in 1815 was finally ceded to Prussia. It has a university, founded in 1456. The church of St. Nicholas has a valuable library and a tower 330 feet high. Greifswald has a large corn trade with England, France, and the Mediterranean.

Greiz, a German town, capital of the small principality of Reuss Greiz, is on the right bank of the White Elster, 14 miles S.W. of Zwickau. Its history goes back to the 12th century. In 1550 it came into the possession of the house of Planen. It has been twice destroyed by fire, in 1494 and 1802. The old town church (13th century), the old "Residenz," and a summer palace are the chief buildings. Dyeing and tanning and the manufacture of different kinds of cloth and paper are carried on.

Grenada, one of the British West Indian islands, belongs to the Windward Isles, and is 60 miles from the South American coast, and about the same distance to the north of Trinidad. It is 24 miles long and 12 miles broad. It was discovered by Columbus in 1498, but not settled till the French came to it from Martinique in the middle of the 17th century. It was taken by the British in 1762, but did not finally come into their hands till the peace at the close of the American War (1783). The

soil of the island is very fertile; fruits, nutmegs, and cocoa are the chief productions, and turtles abound on the coast. Ranges of mountains run across, and there are two inland lakes. Grenada is a Crown colony, and has a lieutenant-governor and a council nominated by the Crown. The capital is Georgetown on the south-western coast.

Grenade, a small explosive missile, usually thrown by hand; they were formerly much more used than they are now.

Grenadiers, originally soldiers who threw hand-grenades. The name was afterwards given to the men belonging to the first company of each battalion of infantry, who were distinguished by their height and fine physique, as well as their tall bearskin caps. The Grenadiers now form the first three battalions of the foot-guards.

Grenoble, a town in the south-west of France, formerly capital of the province of Dauphiné, and now of the department of the Isère, on the left bank of which it stands, being 58 miles east of Lyons. It has a very fine situation, looking to the east towards the Alps, and encompassed by hills to the north and west also, though having the rivers Isère and Drac between. The city passed from the Burgundians to the Franks, and again was included in a Burgundian kingdom. In the 13th century it came under the power of the Counts of Albon, afterwards called Dauphins, and in 1349 was ceded to France. Under the governorship of Lesdiguières ("Le roi des Montagnes"), after the accession of Henri IV., it acquired great importance, and in 1788 it vigorously defended its privileges against the central government. It received Napoleon on his return from Elba, but was speedily retaken. Its situation between two rivers has made it liable to floods, the worst of which have been in 1219, 1778, and 1859. Its chief buildings are the cathedral of Notre Dame, of which Charlemagne is the traditional founder; the church of St. André (13th century), to which the tomb of Bayard was removed in 1822; the church of St. Laurence, with an 11th-century crypt; and the Palais de Justice (15th and 16th century). There is a university and a valuable library, and among the many institutions are the Académie Delphinale, a large hospital, and a benefit society, which was one of the earliest of its kind. Grenoble is protected by the Bastille standing on the hills towards the north, and has an important school of artillery. It has an extensive glove trade, and liqueurs, straw-hats, and leather are also made.

Grenville, GEORGE (1712-1770), an English statesman, was the second son of Richard Grenville, of Wotton, Bucks. He was educated at Oxford, and was called to the Bar in 1735. Six years later he was elected member for Buckingham, which he represented till his death. He joined the party called the "Boy Patriots," and acted with the Opposition even after his appointment in 1744 as a Lord of the Admiralty. Three years later he went to the Treasury as Junior Lord, and in 1754 became a Privy Councillor after accepting office under Newcastle. He still, however, acted with

Pitt and his brother Lord Temple, and resigned the post of Treasurer of the Navy soon after his appointment both in this and the Devonshire Administration. Having accepted it a third time in 1757, he succeeded in carrying a useful measure providing for the payment of seamen's wages. In 1761 Grenville became a Cabinet Minister, and next year was named one of the Secretaries of State under Bute, but soon exchanged this office and the leadership in the Commons for that of First Lord of the Admiralty. He had now for some time broken with Pitt, and in a debate in March, 1763, in which Grenville defended the proposed cider duty by repeatedly asking to be told where new taxes might be laid, that statesman covered him with ridicule by quoting a popular song, "Gentle shepherd, tell me where." The name of the "Gentle Shepherd" stuck to the unfortunate Grenville for years afterwards.

Nevertheless, on the resignation of Bute a month later, Grenville became Prime Minister and Chancellor of the Exchequer, but was very soon obliged to insist on the cessation of the secret influence of the king's favourite. On April 30 Wilkes was arrested under a general warrant for his attack on the King's Speech in the *North Briton*. The king made two attempts to get rid of his Minister in the summer, but failed, and in September the Duke of Bedford and his friends joined the Ministry. In March of the following year a resolution declaring the possible desirability of imposing stamp duties on the colonies passed quietly through the House, and on February 7, 1766, the resolutions definitely imposing them met with as little opposition. After the exclusion of the Princess Dowager's name from the Regency Bill, George III. made another attempt to oust Grenville, and again failed, but soon after induced Rockingham to form a government. Grenville was dismissed in July, 1765. Next year he ably defended the Stamp Act, and in 1767 succeeded in defeating the Ministry on the budget. In the following year he "inspired" a pamphlet which drew a reply from Burke.

In February, 1769, Grenville in an able speech opposed the expulsion of Wilkes from the House; and before his death in 1770 succeeded in carrying an important measure by which the trial of election petitions was transferred from the House of Commons to a Select Committee. George Grenville was an able financier, and possessed such a good knowledge of the business of the House that he was at one time destined for the Speakership. He had a strong sense of duty, great industry, and absolute integrity; but these good qualities were balanced by a lawyer-like narrowness of view, a tendency to verbosity, and a dictatorial manner which offended the king and many of his own colleagues. Burke, in one of his speeches, paid a noble tribute to his character.

Grenville, SIR RICHARD, English seaman, was born in 1540. In 1585 he led a successful expedition against Spanish commerce in the West Indies. In 1587-88 he belonged to the Council which was appointed to take measures against the threatened invasion by Spain, and in 1591 in the *Revenge* he

took part in Lord Thomas Howard's expedition to the Azores. In the course of this a strong Spanish fleet was fallen in with, and Lord Thomas ordered his force to withdraw. The order was, however, disobeyed by Grenville, who threw himself into the midst of the enemy, and, after performing prodigies of valour, was obliged to strike. He died two days later on board the Spanish flagship from the effects of his numerous wounds.

Grenville, WILLIAM, LORD (1759-1834), youngest son of George Grenville, entered Parliament in 1782, and was the same year appointed Chief Secretary under his brother, Earl Temple, who was Lord-Lieutenant of Ireland.

In 1783 he became Paymaster-General under his cousin William Pitt, and also a Privy Councillor. He afterwards held a commissionership on the Board of Control (India), and the vice-presidency of the Board of Trade, and in 1789 was elected Speaker, but resigned a few months later on accepting the office of Secretary of State. In 1790 he also became President of the Board of Control, and in the same year was created a peer, and took the leadership of the Government in the Upper House. In 1791 he became Foreign Secretary. As such he in the following year introduced the Alien Bill, and in 1793 the Habeas Corpus Suspension Bill. In 1795 he passed through the Treasonable Practices Bill and the Seditious Meetings Bill, and in 1799 moved the resolutions for the Irish Union in a four hours' speech. As the measure prepared by himself and Pitt for the emancipation of the Irish Catholics was rejected by the king, they both resigned early in 1801. In his opposition to Addington, Grenville was associated with Fox, and he refused to join Pitt in 1804 because the king would not agree to the inclusion of that statesman in the Cabinet. The cousins had long had divergencies of views on some political questions, and they never afterwards acted together. In 1806 Grenville became head of the Ministry of All the Talents, with Fox as Foreign Secretary. Though the Administration was not as a whole successful, it passed the Bill to abolish the slave trade early in 1807. It did not long survive, as the king not only refused to assent to a Bill for enabling Catholics to hold commissions in the army and navy, but even tried to extort from his ministers a promise that they would never again offer him advice upon the Catholic question.

Overtures to Grenville and his friends to join the Tory Ministry were several times made by the Regent, but their views on Emancipation and other questions prevented the favourable reception of them. Lord Grenville during the next few years continued to lead a section of the Opposition which, while opposing the home and financial policy of the Government, gave their foreign policy a general support. After 1823 he retired altogether from public life. Lord Grenville had all the good qualities of his father, and also his defects of manner, but was, perhaps, a better speaker. He was one of the statesmen who earliest adopted the principles of Adam Smith, and was an able advocate of many social reforms. In foreign affairs he was

in favour of a policy more warlike than that of which the majority of the Whigs approved.

Gresham, Sir Thomas (d. 1579), founder of the Royal Exchange, was the second son of Sir Richard Gresham, Lord Mayor of London, and was born about 1520. After leaving Cambridge, he was apprenticed to his uncle Sir John Gresham, and also assisted his father. In 1551 he became "king's merchant," or royal agent abroad, and went to live at Antwerp, where he negotiated loans and contracted for the supply of military stores. He was also occasionally employed in diplomatic affairs. In 1565 he offered to build an Exchange at his own cost if the City would provide a site, and the foundation-stone was laid on June 7, 1566. Two years later it was ready for use, and in 1570 was visited by Queen Elizabeth. From the large fortune he had amassed the Gresham Lectures were also endowed, and also eight almshouses. At his house in Bishopsgate Street he gave splendid entertainments, the Queen, Lord Burghley, and Leicester being among his guests. *The Life and Times of Sir Thomas Gresham*, by the Rev. J. W. (Dean) Burgon, appeared in 1889.

Gretna Green, a small hamlet in Dumfrieshire on the English border, 9 miles N.N.W. of Carlisle, was for long a retreat of smugglers, and was also the place where runaway matches from England, called, from its position, "Border" or "Gretna Green" marriages, took place. In 1856 these marriages were made invalid, unless one of the contracting parties had resided in Scotland for three weeks before the ceremony.

Grétry, André Ernest (1741–1813), a French operatic composer, was a native of Liège. He spent five years at the Liège College at Rome, where he first won success with an Italian *intermezzo*. After leaving Rome he went for a time to Geneva, where he met Voltaire, but ultimately decided to live in France. Here he wrote the music for Marmontel's *Le Huron*, produced in 1768. He afterwards composed some fifty operas, the best of which were *Zémire et Azor*, and *Richard Cœur de Lion*, the latter containing the air, *O Richard, O mon Roi, l'univers t'abandonne*, so famous in the history of the Revolution. He received honours from each of the successive governments which followed, and died at the Hermitage, Montmorency, where Rousseau had once lived. Grétry was deficient in knowledge of harmony and instrumentation, but his music abounds in the peculiarly French grace of expression.

Greuze, Jean Baptiste (1725–1805), a great French *genre*-painter, was born at Tournus. He was taken up by a portrait-painter named Grandon, whom he accompanied to Paris, where he worked at the Académie schools. He was patronised by De Jally, and after many previous successes, exhibited in 1755 his *Aveugle Trompé*. In 1761 *L'Accordée de Village*, now in the Louvre, was exhibited, and the year 1765 saw the production of *La Bonne Mère*, *Le Mauvais Fils Punie*, and *La Malédiction Paternelle*, the last two of which are in the Louvre. In 1769 he was received by the

Académie, but it was intimated at the same time that it was on the ground of his *genre* pictures only. The result was that Greuze ceased to exhibit. He died in great poverty, caused mainly by his own extravagance. He became acquainted with Diderot through his marriage to the daughter of a bookseller whose shop the philosopher frequented. Greuze owed much to his choice of subjects and to his engravers, notably Massard, for his treatment was generally in a high degree artificial.

Greville, Charles Cavendish Fulke (1794–1865), author of the well-known memoirs, was the son of Charles and Lady Charlotte Greville. Having been educated at Eton and Christ Church, he was appointed private secretary to Earl Bathurst at the age of twenty. In 1821 he became Clerk of the Council in Ordinary, an office which he held till 1860. In the discharge of his duties he not only saw much of Court life, but was brought into contact with the leading statesmen of both parties. Thus the *Diary*, in which he recorded his experiences, and left in the hands of Mr. Henry Reeve for publication after his death, is a highly important historical document. It was given to the world in three divisions. The first, dealing with the reigns of George IV. and William IV., appeared in 1875; the second, extending from 1837 to 1852, was published ten years later; and the last, bringing the memoirs down to 1860, in 1887.

Grévy, François Paul Jules (1813–91), third President of the third Republic, was born at Mont-sous-Vaudrey in the Jura. He adopted the profession of an advocate, and appeared in many political cases as the defender of Republicans. In 1848 he was returned to the Constituent Assembly, where he usually voted with the Extreme Left. He was a frequent speaker, and became Vice-President of the Assembly. He opposed the designs of Louis Napoleon, and after the *coup d'état* withdrew for a time from public affairs. In 1868, however, he returned to the Assembly, and opposed the Empire in its last days. In February, 1871, he was elected President of the Assembly, and was re-elected in 1876, 1877, and 1879. He opposed MacMahon as he had Louis Napoleon, and was elected as his successor in the presidency of the Republic in January, 1879. Though not inspiring much enthusiasm, he was re-elected in 1885 by a large majority, but resigned in December, 1887, owing to the discovery that his son-in-law, M. Wilson, had been trafficking in decorations.

Grey, Charles, 2nd Earl (1764–1845), statesman, belonged to a Northumberland family. He was educated at Eton and Cambridge. Entering Parliament in 1786, he attached himself to the party of Fox, and took part in the impeachment of Warren Hastings. He gave his support to the Society of the Friends of the People, which advocated Parliamentary reform; but his motion for inquiry into the matter in 1792 and 1793, and his scheme of reform in 1797, all fell to the ground. Meanwhile he maintained a constant opposition to Pitt's Government, and brought forward a motion for his impeachment. In 1806 Grey, now Lord

Howick, became First Lord of the Admiralty in the Fox-Grenville Ministry, a post which he soon exchanged for that of Foreign Secretary, becoming at the same time Leader of the House of Commons. He succeeded in passing a Bill abolishing the slave trade; but the difficulties that arose in regard to the Catholic Relief question resulted in the fall of the Ministry (1807). During the same year he succeeded to his father's earldom. After refusing to join Canning in 1827, he became Prime Minister and First Lord of the Treasury in the reforming Cabinet formed on the accession of William IV. The first Reform Bill, brought forward in March, 1831, was rejected in the Commons; the second passed safely through the new House, which met in June, but was thrown out by the Lords in October; in 1832 the third was read a second time in the Upper House, but, in consequence of the success of Lord Lyndhurst's motion to postpone the disfranchising clauses until the enfranchising clauses had been discussed, the Ministry resigned. On the failure of Wellington to construct a Cabinet, Grey returned to office, and on June 4th the Bill was accepted by the Lords. Henceforward he found himself out of sympathy with the advanced views of his more Radical colleagues; and, after passing an Act for the abolition of negro slavery in the colonies, he resigned in July, 1834.

Grey, RIGHT HON. SIR EDWARD (b. 1862), sat for North Berwick since 1886; he was Under Foreign Secretary from 1892-5, and in 1905 joined the Liberal Ministry as Secretary for Foreign Affairs; in 1906 the Liberals won the election, and returned to office.

Grey, SIR GEORGE (1799-1882), statesman, was a nephew of Earl Grey. Soon after his entrance into Parliament (1832) he became Under-Secretary for the Colonies (1834-39), and as such delivered some forcible speeches in support of the action of the Government in Canada and Jamaica. As Home Secretary under Lord John Russell (1846-52), he showed both firmness and judgment in his method of dealing with the Chartist agitation. In 1849 the disturbed state of Ireland forced him to introduce a Bill suspending the Habeas Corpus Act. After holding office as Colonial Secretary under Lord Aberdeen (1854), he became Home Secretary in the first and second Ministries of Lord Palmerston (1855-58, 1859-65). During this period he introduced several reforms in matters of prison discipline, improving the ticket-of-leave system, and passing the Prison Ministers' Bill, which provided that Nonconformists should be attended by their own ministers. Sir George Grey remained in office under Earl Russell, but resigned in 1866.

Grey, SIR GEORGE, K.C.B. (b. 1812), Colonial administrator, entered the army in 1829, but retired after ten years' service. From 1837 to 1840 he was engaged in exploring Western and North-western Australia. He became Governor of South Australia in 1841, of New Zealand in 1845, and of Cape Colony in 1854. During a second residence in New Zealand as governor (1861-67) he brought the Maori War to a successful termination. He was appointed superintendent of West Auckland in 1875, and was

Premier of New Zealand 1877-84. He was very successful in establishing friendly relations between the natives and the whites. He died in 1898.

Grey, HENRY, 3RD EARL (b. 1802; d. 1894), eldest son of the second Earl, first entered Parliament in 1826. He was Secretary for War 1835-39, and Colonial Secretary 1846-52. He afterwards opposed the Crimean War and the Eastern policy of Lord Beaconsfield. He published *The Colonial Policy of Lord Russell's Administration*, his father's *Correspondence with William IV*, etc.

Grey, LADY JANE (1537-54), was the eldest daughter of Henry Grey, Marquis of Dorset. Her mother was the Lady Frances Brandon, daughter of Charles Brandon, Duke of Suffolk, and Mary, sister of Henry VIII. She was born at Bradgate, her father's seat in Leicestershire, and was brought up by her parents in a very strict manner. At an early age she evinced extraordinary talent, and made great progress in Latin, Greek, Hebrew, Italian, and French, under her tutor, Aylmer, afterwards Bishop of London. She was also a skilled musician. Roger Ascham has left a well-known description of her home-life, telling how he found her reading Plato in solitude while the rest of the family were hunting in the park. After her father's elevation to the dukedom of Suffolk (1551) she passed much of her time at court. During Edward VI.'s last illness the crafty John Dudley, Duke of Northumberland, formed a scheme for securing the succession to his own family by uniting the Lady Jane to his fourth son, Lord Guildford Dudley. The marriage was solemnised in May, 1553. By exciting Edward's religious prejudices, Northumberland succeeded in inducing him to name Jane his successor; and on July 9th, three days after his death, she was proclaimed queen, much against her own will; but the people remained loyal to the Princess Mary, and after a nominal reign of nine days Jane was placed in the Tower. After remaining there for four months she was beheaded, together with her husband, on Tower Hill.

Greyhound, a large variety of the domestic dog, and one of the oldest forms, for it is figured on Egyptian monuments that are about five thousand years old. Greyhounds hunt by sight, and have long been bred for speed for coursing (q.v.), and to this quality, and in a less degree to courage, due to a strain of bull-dog blood, everything else has been sacrificed. A greyhound should stand about 24 inches at the shoulder; the head should be wide and flat with powerful jaws, the eyes dark and bright, the ears small and fine, the neck long and muscular, the shoulders sloping and very muscular, the chest deep and wide, the back square, beam-like, and long; the loins well-developed, the fore-legs well set under the body, the feet rounded with large soles, the hind-legs well bent at the hocks, and the stern fine, long, and curved. The usual colours are black, red-white, brindled, fallow, fawn, or a mixture of some of these, but no good dog is of a bad colour.

Greywacke, a half-translation of the German *grauwacke*, the name of a rock, generally grey,

though sometimes black or brownish, compact, with rounded or subangular grains and fragments of quartz, felspar, slate, etc., in a cement, usually siliceous, but sometimes argillaceous, calcareous, or anthracitic; though, when fine-grained, it resembles crystalline rocks, greywacke is of aqueous origin. It is sometimes ripple-marked or sun-cracked, being, in fact, a Palaeozoic near-shore deposit; but it is much indurated by pressure and often cleaved or otherwise altered. It forms so large a part of the Cambrian, Ordovian, and Silurian systems (q.v.) that at one time they were known as the Greywacke series.

Gridiron Pendulum is a special form of pendulum constructed so that its period of oscillation shall be independent of variations in temperature. This period depends on the distance of the centre of gravity of the pendulum from its point of support, and in the ordinary type of pendulum this is increased by expansion of the pendulum rod when the temperature rises, the effect being to make the pendulum oscillate more slowly. In the gridiron form, which is due to Harrison, the downward expansion of the central bar, which may be of iron, is compensated by the upward expansion of two lateral bars of another metal such as zinc, whose expansion coefficient is greater. These are supported on a cross-piece fixed transversely at the lower end of the central bar. These lateral pieces support another cross-piece at their upper extremity which may again carry a pair of iron bars from which the pendulum bob hangs. If the upward expansion of the zinc be not sufficient to balance the downward expansion of the iron, further addition of pairs of bars of zinc and iron must be added till the required ratio between the length of iron and of zinc be obtained. The mercurial pendulum (q.v.), due to Graham, is a much more compact arrangement for compensation on the same principle.

Grieg, EDVARD HAGERUP (b. 1843), an eminent modern composer, who has given a new impulse to Scandinavian music. He was born at Bergen, and, after studying at the Leipzig Conservatorium and at Copenhagen, became director of the Musical Association at Christiania in 1867. His works include various orchestral suites, a piano concerto with full orchestra, some piano sonatas, duets for violin and piano, and some beautiful songs. He visited England in 1889, and died in 1907.

Grierson of Lag, Sir ROBERT (d. 1733), was steward of Kirkcudbright in the reign of Charles II., and distinguished himself by his cruel persecution of the Covenanters.

Griesbach, JOHANN JAKOB (1745–1812), German theologian, was born in Hesse-Darmstadt. He became extraordinary professor of theology at Halle in 1773, and in 1776 ordinary professor at Jena, where he was afterwards rector. His chief work was his critical edition of the New Testament, which appeared in 1774.

Griffin, a fabulous monster, described by Ctesias as a four-footed bird, dwelling in the mountains of India, of the size of a wolf, but with legs and claws

like a lion. The feathers on the body are black, but those on the breast are red. In heraldry it is usually described as half-eagle and half-lion. It is composed of the head, neck, wings, legs and talons of the former, conjoined to the body, tail, and hind legs of the latter; but the head, unlike that of the eagle, is adorned with a pair of ears. It probably owes its origin to the ancient armorial practice of dimidiation. It occurs in heraldry in most of the ordinary positions of the lion, but when the griffin is placed in the position known as "rampant," it is then always termed "*segreant*." The sex of this creature is not determined, but there exists in heraldry another equally chimerical conception known as the "male griffin," differing from the "griffin" only inasmuch that it is deprived of wings and is adorned with spikes at various points about its body.

Griffin, GERALD (1803–40), a novelist, born at Limerick, settled in London in 1823. His novels, among which *The Collegians* (1828) (on which was founded the play *The Colleen Bawn*) was the most successful, are now little read. He eventually entered the Society of the Christian Brothers at Cork.

Grig. [EEL.]

Grillparzer, FRANZ (1791–1872), Austrian dramatist, was born in Vienna. In 1813 he entered the service of the government, from which he retired in 1856, after holding the post of Keeper of Archives at the Ministry of Finance for 23 years. In 1817 his first tragedy, *Die Ahnfrau*, was acted with much success in Vienna. *King Ottocar* (1822) was also well received, but his great classical dramas *Sappho* (1819) and *The Golden Fleece* (1821) are not well adapted for the stage.

Grilse. [SALMON.]

Grimaldi, JOSEPH (1779–1837), comedian, the son of an Italian dancing-master, was born in London. He appeared at Drury Lane theatre before he had completed his second year. His *Memoirs* were edited by Charles Dickens, who describes him as "the genuine droll, the grimacing, filching, irresistible clown."

Grimm, FRIEDRICH MELCHIOR, BARON VON (1723–1807), a German man of letters, was born at Ratisbon. He went to Paris as tutor to the Count de Schomberg, and there became intimate with Rousseau and the Encyclopedists. His literary correspondence with the Duke of Saxe-Gotha and other German princes, which grew out of this connection, displays much critical acumen in its judgments on contemporary French literature. In 1776 Grimm became the minister-plenipotentiary of the Duke of Saxe-Gotha in France, and in 1795 he was employed by Catherine II. of Russia as her minister at Hamburg. He died at Gotha.

Grimm, JAKOB LUDWIG KARL (1785–1863), and **WILHELM KARL** (1786–1859), philologists and antiquaries, were the sons of a public notary at Hanau. The brothers remained together throughout almost the whole of their lives. At the university of Marburg, where they studied law, they fell

under the influence of Savigny. In 1808 Jakob was appointed librarian to Jérôme Bonaparte, King of Westphalia, who held his court near Cassel, and thither he was followed soon afterwards by his brother. The natural bent of the brothers towards the study of folklore and old legends received a fresh impulse from the friendship formed by Wilhelm with some of the leaders of the romantic school, and in 1812 appeared the *Kinder- und Haus-Märchen*, consisting of the fairy tales they had collected, mainly in the wild districts in the neighbourhood. This volume has become a household favourite in every country of Europe, and has also done much to promote the scientific study of folklore. Jakob was present as Secretary of Legislation at the Congress of Vienna, and in 1815 was sent to Paris to recover the MSS. and art treasures stolen by the French. In 1816 he became second librarian in the Cassel museum, where his brother already held a post. Here they remained until 1828, publishing their collection of *German Sagas* in 1816-18. In 1819 appeared the first volume of Jakob's *German Grammar*, the second edition of which (1822) contained the enunciation of Grimm's law (q.v.). In 1828 the brothers removed to Göttingen, Jakob as Professor of German Literature, Wilhelm as sub-librarian. Jakob's *German Mythology* was published in 1835. In consequence of their protest against the unconstitutional measures of King Ernest Augustus, they were banished from Hanover in 1837. In 1840 they were invited to Berlin. They now undertook the gigantic *German Dictionary* which is still incomplete. Jakob's *Grammar* and *Mythology* were epoch-making works in their respective spheres. Of Wilhelm's independent writings the most important was the *German Hercic Sagas* (1829.)

Grimm's Law, the law regulating the interchange of consonants in the Aryan languages (q.v.). Though to some extent anticipated by Rask and others, the discovery was first embodied in a definite law by Jacob Grimm in the 2nd edition of his *German Grammar* (1822). The rule is that an aspirate in Sanskrit, Greek, Latin, Keltic, Slavonic, and Lithuanian corresponds to a flat mute in the Low German and Scandinavian and a sharp mute in the Old High German and kindred Teutonic dialects; a flat mute in Sanskrit, etc., to a sharp mute in Low German and an aspirate in High German; a sharp mute in Sanskrit, etc., to an aspirate in Low German and a flat mute in High German—as exemplified in the following table:—

Sanskrit.	Latin.	Gothic.	O. H. Ger.	English.
dhivira	fores	daur	tor	door
dasan	decom	taihun	zehan	ten
tvam	tu	thu	du	thou

The law applies equally to dentals, labials, and gutturals. It does not always hold good, as it may be interfered with by the action of other laws. Dr. Morris in his *English Accidence* remarks that "no satisfactory explanation has yet

been given of this permutation of consonants throughout the Indo-European family of languages."

Grimmelshausen, JOHANN JAKOB CHRISTOF VON (d. 1676), a German novelist, whose works give a vivid impression of the social condition of Germany after the close of the Thirty Years' War. Grimmelshausen had himself served in the war, and afterwards strolled from place to place, finally settling down as bailiff to the Bishop of Strasburg. His materials were thus largely drawn from his own experience. His best work is his *Simplicissimus* (1669).

Grimsby, GREAT, a Parliamentary and municipal borough, seaport, and market-town in Lincolnshire, 30 miles N.E. of Lincoln. It is situated at the mouth of the Humber, about 7 miles from the North Sea. The town, as the name denotes, dates from the period of the Danish occupation. It was a thriving port as far back as the reign of Edward III., and contributed ten ships to the siege of Calais. Since the construction of the new docks in 1849-58 it has become the chief fishing centre on the east coast. Cod and herrings are conveyed in large numbers to the great manufacturing towns by means of the Great Northern and the Manchester, Sheffield, and Lincolnshire railways. The inhabitants are also engaged in ship-building, and there are tanneries, breweries, and ropewalks. Pop. (1901), 63,138.

Grindal, EDMUND (1519-83), Archbishop of Canterbury, was born in the parish of St. Bees, Cumberland. He was educated at Cambridge, where he became fellow (1538) and vice-master (1549) of Pembroke Hall. He remained in Germany during the reign of Mary. In 1559 he was appointed Bishop of London, whence he was translated to York in 1570 and to Canterbury in 1575. In 1577 he was suspended for refusing to prohibit "prophesyings,"—i.e. meetings of the clergy for the purpose of expounding the Scriptures—but he was reinstated the year before his death.

Grindelwald, a valley of Switzerland in the Bernese Oberland, 36 miles S.E. of Berne. The valley, famous for its beauty, lies at the foot of the Eiger, Mettenberg, and Wetterhorn mountains, and forms the approach to the Upper and Lower Grindelwald glaciers.

Gringoire, PIERRE (d. 1544), a French poet, said to have been born at Caen. He was the chief member of the theatrical company called "Enfants sans Souci," but his later poems deal with religious themes only. His chief compositions were *Le Jeu du Prince des Sots*, a satire against Pope Julius II. (1511), *Les Folles Enterprises*, allegorical pieces in which he sets forth the abuses in Church and State, *La Chasse du Cerf des Cerfs*, a political satire, and the *Mystère de Monseigneur Saint-Loys*.

Griping. [COLIC.]

Griqualand, the name of two British possessions in South Africa, so called from the Griquas, a mixed race sprung from the Dutch and Hottentots. **GRIQUALAND WEST** has formed a part of Cape Colony since 1880. It is bounded by Bechuanaland on the N., the Orange River Colony

on the E., the Kalahari desert on the W., and the Orange River on the S. The diamond-fields have been worked continuously since their discovery in 1867, and are still a source of great wealth. **GRQUALAND EAST**, situated between Kaffraria and Natal, was annexed to Cape Colony in 1875. It is governed by a chief magistrate with nine assistants.

Griquas, a Hottentot people, South Africa, with a large strain of Dutch blood, hence called *Baastards* by the Boers. There are two divisions, those of Griqualand West and Griqualand East, both now comprised within Cape Colony, and subject to British administration. At the beginning of the eighteenth century they already formed numerous tribal groups settled in the Roggeveld uplands, from which they were driven beyond the Orange river by the English settlers about the year 1820. Here some established themselves in the present district of Griqualand West, while others moved up the right bank of the Orange, and in 1852 crossed the Drakenberg range and settled under their leader, Adam Kok, in the district of Kaiflind, south of Natal, now known as Griqualand East. They are a harmless, industrious people, mostly Christians of Dutch speech, but physically of unmistakable Hottentot type. (*Livingstone, Missionary Travels*, 1852; *Silva White, Handbook of South Africa*, 1880.)

Griselda. The story of "patient Grisild," immortalised by three great writers of the 14th century, cannot be traced farther back than Boccaccio. In the *Decamerone* it is the last tale told on the 10th day, thus closing the series. In or about 1373 Petrarch wrote his *De obedientia et fide uxoria Mythologia*, with a prefatory letter of admiration addressed to Boccaccio. Chaucer closely follows Petrarch, whose version differs in some respects from that of Boccaccio. As Petrarch was in the habit of narrating the story in conversation, Chaucer may have learnt it from him orally during his visit to Italy in 1373 as well as from his written version. So much at least may be gathered from the allusions to Petrarch in the prologue to the *Clerkes Tale*. Moreover, the mention of Petrarch's death as a recent event, as well as other internal evidence, shows that the *Clerkes Tale* was written a considerable time before it was embodied in the *Canterbury Tales*. The Clerk tells how Griselda, the daughter of a humble retainer of the Marquis of Saluzzo, won that lord's affection by her maidenly virtue and her loving care of her aged father; how when he was importuned by his vassals to marry, Griselda became his bride; how to test her constancy he deprived her of her children and sent her home in disgrace, and how, when she remained true to him through all, he received her back with the assurance that he indeed possessed the model of a perfect wife. Among other versions of the tale may be mentioned *Le Mystère de Griseldis*, acted in Paris in 1393, the prose version in *Le Ménagier de Paris* of about the same date, Lydgate's mention of Griselda in the *Temple of Glass*, several English ballads, and two plays of the 16th century, including one by Dekker, Chettle, and Haughton.

Grisi, Giulia (d. 1869), operatic singer, was born at Milan in or about 1810. After performing with success at Florence, Pisa, and Milan, she made her *début* at Paris in 1832 as Semiramide in Rossini's opera. In 1834 she appeared in London, which henceforward became her home. Among her chief *rôles* were Adalgisa in *Norma*, Desdemona in *Otello*, and Amina in *La Sonnambula*.

Grison (*Galictis vittata*), a large South American weasel lighter on the upper than on the under surface.

Grisons, Graubünden, the largest and most easterly of the Swiss cantons, lies between Tyrol on the north and Como and the Valtelline on the south, and is 80 miles in length by 45 in width, and contains 2,963 square miles. Most of the canton belongs to the Alpine region formerly known as the Rhätian Alps, and, except in the valley of the Rhine and in the valleys upon the Italian side, has a thoroughly Alpine climate and scenery, about one-tenth of the surface being occupied by glaciers. There are five groups of glaciers, one of which contains the chief source of the Rhine. The principal valleys are the Engadine, or Upper Inn valley, and the Vorder and Hinter Rheinthäler, which latter, with side valleys opening from them, form the Upper Rhine basin. There are also the valley of the Upper Inn, and the Italian river valleys of Misocco, Bregaglia, and Poschiavo, which are more or less fertile, the most fertile regions being the Prättigau and the Rheinthal below Ilanz. The Rheinthal below Chur produces good wine, and the Italian parts produce maize and chestnuts, and the other ordinary produce of the region, and the Poschiavo valley produces good tobacco. There is also some export of Valtelline wines. The scenery of the inner regions is wild, and there are some lofty points, Piz Bernina rising to a height of over 13,000 feet. The Upper Engadine and Davos are coming into vogue as health-resorts for consumptive patients, the dry clear air being very beneficial in cases of this sort. Mineral springs are numerous. In the upper regions crops ripen with difficulty or not at all, but there is an abundant hay-harvest, and the forests are a source of wealth, while the pastures support many cows on the lower slopes and sheep upon the upper. There are several good and long-known passes through the Rhätian Alps. In many parts the Romanisch dialect—probably a relic of the *lingua rustica* of Rome—is spoken, though German is generally understood. Many of the inhabitants migrate to other parts of Europe to swell the great army of Swiss confectioners and café proprietors, but usually return when they have acquired a competence.

Grit, a coarse-grained sand or, more often, sandstone. The Silurian grits of Denbighshire and of the Coniston district and the Millstone grit of the Middle Carboniferous are well-known examples of this rock.

Grizzly Bear (*Ursus ferox*), from the Rocky Mountain region, the most carnivorous and ferocious species of the genus. The fur is dark brown, and adult males attain a length of nearly nine feet.

Groat, a mediæval coin worth fourpence. The name is derived from the old Low German word *grote*, "great," which is said to have been used in the first instance to describe certain coins of Bremen of a larger size than was usual. The first English silver groats were coined in the reign of Henry III. The coinage ceased in 1662.

Grodno, a western government of Russia, lying between lat. 52° and 54° N., and long. 23° and 26° E., having Wilna to the north, Minsk to the east, Volhynia to the south, and the old kingdom of Poland to the west, and containing about 15,000 square miles. The region consists for the most part of an alluvial sandy plain, in places swampy, in others covered with pine-forests, ill-fitted for the growth of fruit or vegetables, but producing fair crops, cattle, and bees; and there is a not inconsiderable export of grain, wool, cotton, and timber. The climate is misty, damp, and cold. One of the forests is said to contain bison. The principal rivers are the Niemen, Narev, Bobia, and Bug, and there are many canals. The town of Grodno, on the right bank of the Niemen, is the seat of the provincial government, and has a fine government office, and two palaces of the Kings of Poland. Here it was that the last King of Poland abdicated. There is railway communication with St. Petersburg, Moscow, and Warsaw.

Grog, in the navy, a mixture of spirit and water, served out in that form to prevent intoxication. The proportion, if the spirit be rum, is usually two parts of water to one of rum. Grog probably takes its name from Admiral Vernon, who introduced the practice of mixing, and who was known in the service as "Old Grogman."

Grolier, JEAN (1479-1565), was a noted French book-collector. He accompanied the army of Francis to Italy, and did diplomatic service at Milan and Rome. His library, which was scattered about the middle of the 17th century, numbered about 3,000 well-chosen books, bound in the special style known by his name, and some 350 of these have been recovered.

Gromidae, a family of Foraminifera, which are provided with a horny or chitinous shell (or test); there is an aperture at one or both ends for the protrusion of the pseudopodia.

Groningen, a town and province of the Netherlands, at the junction of the Hunse and the Aa, and nearly 50 miles east of Harlingen. The old town is surrounded by a ditch, crossed by eighteen bridges, and there are several open spaces, the largest of which is the Breedemarkt. Five of the principal streets are named after old local families. Among the chief buildings are a town hall, provincial administrative offices, a well-appointed university, and twelve churches, the chief of which are St. Martin's, the Aa church, and the New Church, and an institution for the deaf and dumb. There is a good trade, and among the industries are cotton and woollen-weaving, flax-spinning, rope, salt, beer, vinegar and soap-making, and gold and silver-working. The town is of great antiquity.

Gronovius, JAKOB (1645-1716), was a Dutch scholar, born at Deventer and educated at Leyden. He afterwards visited England, and collated MSS. at Oxford and Cambridge. In 1679 he edited Polybius, and then visited France, returning later to Leyden, and then going to Spain and Italy, in which country he did professional work for two years at Pisa. He then returned to Deventer, but was shortly made professor at Leyden, where he passed the rest of his life. Besides his chief work, *Thesaurus antiquitatum Greccarum*, he edited many of the classical authors.

Gros, ANTOINE JEAN, BARON (1771-1835), was a French painter who occupied in art an intermediate place between the classical and the romantic schools. He was born at Paris, where his father was a miniature painter, and in 1785 began to study under David. He was with Napoleon in Italy, and one of his subjects was Napoleon on the bridge at Arcola. His principal works were *Les Pestiférés de Jaffa*, *The Battle of Aboukir*, and *The Battle of Eylau*, and he had many pupils in his palmy days. Latterly his work fell off in quality, and eventually he committed suicide. Napoleon made him baron of the Empire.

Grosbeak, a name for any finch of the genus *Coccothraustes*, from the size of the bill. The Hawfinch (q.v.) is a good example. The term is also applied to the Cardinal (q.v.).

Grose, FRANCIS (c. 1731-1791), an English antiquary, was born at Greenford in Middlesex, where his father, of Swiss extraction, was a jeweller. He studied art, and his first drawing of note was entitled *High Life below Stairs*. In 1769 he began to exhibit tinted and other drawings at the Academy, many of them being architectural, and illustrated many of his own works. In 1757 he became Richmond herald, and in 1757 F.S.A. He was also adjutant of the Hants militia, and at a later period captain and adjutant in the Surrey militia. In 1787 he published *Antiquities of England and Wales*, and in 1789-91 *Antiquities of Scotland*. His visit to Scotland made him acquainted with Burns, who alluded to him in "A chiel's amang you taking notes, and faith he'll prent 'em," as well as in other poems. A projected work on the antiquities of Ireland was cut short by his death. He published also many other works.

Grossetete, ROBERT (d. 1253), was a Bishop of Lincoln (1235-53) noted for his reforming zeal and his energetic qualities. He was of humble birth, and was educated at Oxford and perhaps at Paris becoming in 1224 rector of the Franciscans at Oxford. He was renowned as a preacher and an exponent of Aristotle. He held many preferments, but in 1231 resigned them all save a prebend in Lincoln cathedral. There was a difficulty about the place of his consecration in 1235, Reading being finally chosen for it. He at once set about visiting and reforming his diocese, being especially severe upon the monasteries. He was present at the signing of the Great Charter, and in 1239 he quarrelled with his Chapter as to his right of including them and their patronage in his visitations. This point

was decided in his favour by the Pope, but he soon became involved in a quarrel with the Abbot of Westminster, another with the king, and another with the Chapter of Canterbury as to their powers during a vacancy of the archiepiscopal throne. In 1244 he laid the foundation of the exceptional judicial powers of the Chancellor of Oxford. In his quarrels he appealed to the Pope, and during a visit to his Holiness at Lyons he inveighed in a sermon against the corruption and venality that prevailed at the Papal Court. There is a notable letter of his extant in which he temperately, but firmly, refused to obey the Pope on a matter where he thought the latter was in the wrong. He left behind him many works both philosophical and scientific. Froude has drawn a good picture of him in his *Short Studies*.

Grosventres ("Paunch"), the Franco-Canadian name of the Hidatsa branch of the Minnetaree Indians, and applied generally to all the Minnetarees. These are the Fall Indians of English writers, who formerly ranged from the Upper Missouri to the South Saskatchewan river. They appear to be most nearly related to the Upsarokas (Crows) of the Yellowstone basin, who are a branch of the Dakota family; but by some ethnologists they are classed with the Arapahoes, who are an outlying branch of the Algonquin stock. They are now either extinct or grouped in reservations with other broken tribes; but the name survives in the Grosventres river, southernmost of the three head streams of the South Saskatchewan.

Grote, George, D.C.L., LL.D. (1794-1871), a noted historian and philosopher, was born near Beckenham, his grandfather being a German from Bremen who established himself first as a merchant, then as a banker, in London. George Grote was educated first at Sevenoaks and then at Charterhouse, where he had for contemporary Connop Thirlwall, though their friendship did not begin till a later period. At the age of 16 he had to enter his father's bank, but continued his classical studies, to which he was devoted, and gave much attention also to German, political economy, music, and philosophy. In 1820 he came under the influence of the Bentham-Mill school of thought, an influence which had a great effect in moulding his own views, while he in his turn exercised much influence upon John Stuart Mill. In 1821 he wrote a pamphlet upon Parliamentary Reform, and in 1822 *An Analysis of Natural Religion upon the Temporal Happiness of Mankind*, which was in a great measure founded upon some MSS. of Bentham. In 1820 he had already taken up the idea of writing a history of Greece, and in 1826 an article of his in *The Westminster Review* upon Mitford's *History of Greece* foreshadowed his line of treatment. Meantime, he, with Mill and others, was greatly interested in the project of founding a London University, though there was some friction between him and them as to filling the professorial chairs. In 1830 he was in France and displayed practical sympathy with the revolutionary cause. In 1831 he wrote a further pamphlet on Parliamentary Reform, and being returned to the House of Commons, sat

during three Parliaments, showing himself an ardent advocate of the introduction of the Ballot, as well as other points of reform. In 1843 he finally left the bank, and devoted himself to the great work of his life. The first two volumes of his history appeared in 1846, and the twelfth and last in 1856. This history came as a revelation to many, not only for the clearness and occasional grandeur of its style, but also for the new points of view which it took and for its marvellous insight into the problems of ancient Greek life and the methods of their settlement. Some difficulties of Swiss political life and their result in the "Sonderbund," and the similarity between them and those of ancient Greek politics, had led in 1847 to the publication in the *Spectator of Seven Letters upon Recent Politics in Switzerland*. In 1865 he published his second great work on *Plato and the Other Companions of Socrates*, and endeavoured to complete his estimate of Aristotle, but failure of health and death prevented this. It was published posthumously. He showed his regard for the new London University by liberal endowment.

Grotfend, Georg Friedrich (1775-1853), a German scholar, noted for his researches into cuneiform inscriptions, was born at Münden in Hanover, and educated there and at the university of Göttingen. His treatise on *Universal Writing* brought him into notice in 1799. He was well-read in Latin and Italian philology, and published a revised Latin Grammar, deciphered some Umbrian fragments, a treatise on Bactrian coins, and a work upon ancient Italy. It was in 1800 that he laid the foundations of modern progress in deciphering the cuneiform inscriptions by discovering that they were Persian, that there were three types of character, one of which was the key to another, and that they were written from left to right.

Groth, Klaus, a Platt-Deutsch writer, was born in Holstein in 1819. For a time he taught in a school of his native place, but later travelled in Germany and Switzerland, and in 1866 became professor of German language and literature in Kiel University. Among his chief works were a poem, *Quickborn*, a collection of poems in the Ditmarsh dialect (1852), prose stories of village life, and rhymes for children. He also wrote poems in Hoch-Deutsch.

Grotius, Hugo (1583-1645), a Dutch controversialist and writer upon international law, was born at Delft, where his father was a lawyer. He was astonishingly precocious in intellect, and at the age of fifteen accompanied the Grand Pensionary and the Count of Nassau on an embassy to France. He studied here for a year, and, returning to Leyden, became a Doctor of Law, and an advocate. He was an adept in Latin verse-writing. In 1603 he became historiographer to the United Provinces, and a question which arose in the Dutch East Indies as to an alleged act of piracy in waters that the Portuguese claimed as their own property led to his writing a treatise, *De Jure Praedae*, which, though not published till the present century, was the undoubted forerunner of his later and widely-known work. In 1610 he

published *De Antiquitate Reipublicæ Batavae*, and was shortly afterwards Pensionary of Rotterdam. In 1613 he formed one of a deputation to England, to discuss some questions that had arisen between the two nations. In 1617, being involved in the theological dispute then raging between the Arminians and Calvinists, he came into collision with the supreme authority, and was sentenced to imprisonment in a fortress for life. By the aid of his wife he escaped in a chest which was used to bring and take away his books, and went to Paris, where in 1625 he wrote his celebrated treatise, *De Jure Belli et Pacis*, which may be looked on as the foundation of the principles of the law of nations, since then developed and systematised by Twiss, Heffter, and others. At a later period Grotius was appointed Swedish ambassador at the Court of France. There are many other works of his extant, but it is to his treatise on international law that he owes most of his reputation.

Grotthüss Theory, in *Electricity*, is a suggested explanation of the actions that take place in an ordinary battery. Given two dissimilar substances such as zinc and copper placed in a conducting liquid such as sulphuric acid, the theory is that under the action of the opposite electricities that are induced on the different metals, the molecules of the conducting liquid have each a constituent that is attracted towards one pole and another constituent attracted towards the other pole. When the circuit is closed by the poles being connected by an external conductor, this tendency for the molecules of liquid to become split up is partially satisfied. Hydrogen in the acid solution is attracted towards the copper, and oxygen, the other constituent of the water, is attracted towards the zinc. Not that hydrogen atoms stream in a free state through the liquid towards the copper pole and oxygen towards the zinc pole; but as soon as a molecule of water near the zinc is split up into its constituents, hydrogen remains there and oxygen combines with a molecule near it, throwing out a previously combined molecule of hydrogen. This seizes the oxygen from a complete molecule near and sets free another molecule of hydrogen. Thus the only free constituents exist at the poles. The theory is rather mechanical, and differs essentially from the modern idea of disassociated constituents (or ions) in the liquid conductor of electricity.

Grouchy, EMMANUEL, MARQUIS DE (1766-1847), a French general who, entering the army at fourteen, took part in the Vendéan campaign, and was appointed second in command to Hoche in the Irish expedition. He saw much service in Italy, and fought in most of the battles of the German campaign, one of his chief feats being the covering of the retreat at the battle of Leipzig. He joined Napoleon after the latter's escape from Elba, and defeated Blücher at Ligny. After Waterloo—which some of his enemies declared to have been lost through his mistake—he conducted the army back to Paris, and then went to America till 1819. In 1831 he returned to France, and was reinstated in his military rank.

Groundling, a popular name for the spinous loach (*Cobitis tanica*), from its frequenting the muddy bottom of rivers. It is distinguished from the loach (q.v.) by its long, compressed body, and the bifid erectile spine below the eye.

Ground-nut, EARTH-NUT, MONKEY-NUT, or PEA-NUT, the short, oblong, cylindrical pod of an annual leguminous plant of tropical and sub-tropical countries, *Arachis hypogaea*. After flowering, the flower-stalk bends down and buries the young pod, which ripens under ground. It has a reticulate surface, and contains one or two seeds. In sandy soil this plant will yield from thirty to thirty-eight bushels of nuts per acre. The seeds taste like almonds, and are largely eaten in many countries, over three and three-quarter million bushels being raised annually in the southern United States. On pressure the seeds yield a large quantity of a bland, yellowish, non-drying oil, an excellent substitute for olive oil. The nuts are largely imported to Marseilles for their oil, chiefly from the west coast of Africa, about 90,000 tons being received annually. They are familiar to English children as "monkey-nuts" and to Americans in "pea-nut candy."

Ground Pigeon, a somewhat loose name for birds of the genus *Goura* (q.v.).

Ground Rent is the rent reserved by a lessor on a grant of lease. It is usually of small amount, the lease being granted for a period of ninety-nine years upon the understanding that the lessee (the builder) shall within a fixed time erect upon the ground one or more messuages of a specified description. When these messuages are built they are sublet to occupants or others, who pay an increased rent estimated to repay the lessee with a profit. The builder's rent, viz. that which he pays to the ground landlord, is termed the ground rent. The ground landlord is entitled under the statute 4 Geo. II., c. 28 to distrain on the premises for the rent, so that it is quite possible that the occupying tenant may have to pay this in addition to his occupation rent unless proper precautions be taken. In the sub-lease there should be a covenant on the part of the sub-lessor (that is, the holder of the original lease) to indemnify his lessee from such payment and to produce receipts from time to time verifying the payment of the ground-rent. Also where several houses are comprised in one lease and then separately sub-leased the whole property is subject to the original ground rent and covenants unless the same have been apportioned (that is, reserved on each house). This makes the dealings with underleases very objectionable and considerably reduces the value of such property.

Groundsel (*Senecio vulgaris*), a common annual weed throughout Europe, whence it has been introduced into all temperate climates. It belongs to the sub-order Tubulifloræ of the order Compositæ (q.v.), and differs from closely allied forms such as the Cineraria (q.v.) in very seldom having any ray-florets. Its branched succulent stem grows a foot high, its leaves are irregularly pinnatifid, and its heads of yellow florets are small. It is gathered as food for cage-birds. A fungus

which attacks it, *Coleosporium senecionis*, proves to be only a stage in the life-history of *Peridermium pini*, the pine-blister, a serious disease of the leaves and bark of pine trees.

Ground Squirrel. [CHIPMUNK.]

Grouse, a book name for birds of the sub-family Tetraonidae, from the northern parts of both hemispheres, distinguished from their allies the partridges in having the legs and toes feathered and the nostrils covered by a soft feathered skin. The males of some American species have a large dilatable sac on each side of the neck, by means of which the love calls are produced in the breeding season, while in other forms the same purpose is attained by the "drumming" made by the rapid motion of the wings. Of the type genus *Tetrao*, two species are British; the Blackcock and the Capercaillie (both which see). The grouse of British sportsmen—the Red Grouse of naturalists (*Lagopus scoticus*), of the same genus as the Ptarmigan (q.v.), is a native of the moors of the north of England and the lowlands of Scotland, but is less common in Ireland. The adult male bird is about sixteen inches in length and the female somewhat smaller. The plumage, consisting of shades of brown, with white and black markings, is eminently protective, and varies considerably according to the nature of the country which the birds frequent. They are generally ground birds, but instances of perching in trees are on record (*Field*, December 17, 1892). They feed on berries and seeds, heather tips, leaves, and the like. The nest is a slight structure, and usually contains from eight to ten yellowish eggs with reddish-brown markings. Grouse shooting in Britain commences on August 12, and closes on December 11. The grouse-disease has been attributed in turn to over-preservation, to the destruction of raptorial birds on the moors to such an extent that sickly game-birds survive and spread infection, and to the presence of a small nematoid worm akin to, if not identical with, that which causes gapes in chicken. The Willow Grouse (*L. albus*), common over the north of Europe, resembles the Ptarmigan in plumage, and, like that species, becomes white in winter. The Ruffed Grouse constitute the genus *Bonasia* in which the lower part of the legs is destitute of feathers and the plumage on each side of the neck erectile. Beside *B. umbellus*, which runs into several varieties, the chief American forms are the Sharp-tailed Grouse (*Pediocetes phasianellus*), with white, black, and brownish-yellow plumage, harmonising with the colour of the soil; the Prairie Hen, Prairie Chicken, or Pinnated Grouse (*Cupidonia cupido*), with two erectile tufts in the nape, and a dilatable air-bladder in shape and colour like a small orange on each side of the neck; and the Cock of the Plains or Sage Cock (*Centrocercus urophasianus*), a fine bird, but with flesh of very bitter flavour, owing its habit of feeding on the wild sage of the western plains. [SAND GROUSE.]

Grove. [ASHERAH.]

Grove, SIR GEORGE, was born at Clapham in 1820. He was trained as an engineer, and took

part with Robert Stephenson in building the Britannia Bridge, and also built some iron lighthouses in the West Indies. He afterwards became secretary to the Society of Arts, and, later, to the Crystal Palace Company. He also edited *Macmillan's Magazine*, edited and partly wrote a *Dictionary of Music and Musicians*, and in 1883 was knighted and appointed Director of the Royal College of Music, being succeeded by Dr. Parry in 1894. He also directed his attention to the East and Bible history, aiding Dean Stanley in his researches, and contributing to the *Dictionary of the Bible*. He died in 1900.

Grove, SIR WILLIAM ROBERT, born 1811 at Swansea, was educated at Brasenose College, Oxford, and was called to the Bar in 1835, was appointed Judge in 1871, and retired in 1887. He studied deeply electricity and optics, and was for a time professor of natural science at the London Institution. In 1866 he was President of the British Association. In 1839 he invented the battery which was called after him, and he wrote on the correlation of physical forces and other points of physical science. He died in 1896.

Grove Cell is a good form of primary battery possessing the advantages of high and constant electromotive force and low resistance. Its disadvantages are that noxious fumes are given off when the battery is working and that the cell is expensive. It is a double-fluid battery, consisting of a zinc plate immersed in dilute sulphuric acid in an outer earthenware vessel and a platinum sheet in an inner porous pot containing strong nitric acid. The zinc, dissolving, causes the production of zinc sulphide and hydrogen. This latter gas is prevented from producing a back electromotive force that would diminish the efficiency of the battery, by passing through the porous vessel into the nitric acid. Here it is oxidised and converted into water, nitric oxide gas being evolved at the same time. The E.M.F. produced is nearly two volts, and if the inner pot be flat-sided and the slab of zinc bent round so as to surround the porous pot, the internal resistance of the battery may be made very small. Bunsen's modification consists of the introduction of a slab of carbon in the place of the platinum-sheet. The E.M.F. is a trifle higher, and the cell is much cheaper.

Growler (*Grytes salmonoides*), a food-fish of the Perch family from the rivers of the United States. It is about two feet long, dark olive above and greyish-white beneath. Its name refers to the noise it makes when taken out of the water. For the same reason sea-perches of the American genus *Hæmulon* are also called Growlers.

Growth (in plants) implies the building up of new organic substance from the food, a change of form, and generally a permanent increase in bulk. It may be said, therefore, to begin in the protoplasm. Its pre-requisites are (1) water, to maintain the turgidity of the cells; (2) a favourable temperature; (3) a supply of the chemical constituents of protoplasm, especially carbonaceous and nitrogenous matters; (4) and in the case of

aërobic plants (q.v.) oxygen for respiration; or, in that of anaërobioses, fermentable material. The mere stretching of cells from increasing turgidity is not growth; but when the stretching of cell-walls is accompanied by their thickening it becomes permanent, and may well be considered as growth. The growth of organs as a whole may be mainly considered as either elongation or increase in girth. Within certain limits a rise in temperature increases the rate of elongation both of shoots and roots; but in nature roots are often so deep as to be practically removed from the varying influence of the sun's heat and then grow continuously. Light is not essential to growth, but has in general a retarding influence, as is seen by the arching of the stems of plants in a window towards the light, their illuminated sides growing more slowly. The entire absence of light, however, stops the chlorophyllian action, and so cuts off one of the main sources of plastic or growing material. Growing organs seem to possess an inherent *rectipetality* or tendency to grow in a straight line, and any *heteranaxisis* or inequality in growth seems to be the result of the varying action of external influences, especially light, gravity, moisture, and contact. From this point of view organs may be divided into those which are *cylindrical*, with *radial symmetry*, such as roots, shoots, or the leaves of rushes and onions, those which are *bilateral* or are *flattened vertically*, as the leaves of *Iris*, and those that are *dorsiventral*, or flattened horizontally, with a contrasting structure on their upper and under surface, as most leaves. The first of these groups, from growth taking place in succession on every side, exhibits *circumnutation*, a nodding or revolving spiral growth. The second group move their growing points in a zig-zag. Dorsi-ventral organs elongate first on one surface and then on the other; but seldom alternate the side more than once or twice. When their upper surfaces grow faster growth is said to be *epinastic*; when the lower, *hyponastic*. Fern-leaves, for example, are at first strongly hyponastic, and so become rolled up in the bud; but afterwards, becoming epinastic, the leaves unfold. The directive influence of light is termed *heliotropism* (q.v.); that of gravity, *geotropism* (q.v.); that of moisture, *hydrotropism*. The action of contact is especially seen in tendrils (q.v.) and climbing plants. Of growth in thickness the most important cases are those of roots (q.v.) by means of a *pericambium*, adding to both xylem and phloem internally and to the cortical tissue externally; of the stems of *Aloe*, *Yucca*, *Dracena*, and other arborescent Monocotyledons (q.v.), in which a *pericyclic*, or zone of fundamental tissue, remains merismatic and gives rise to new but closed fibro-vascular bundles; and of the exogenous stems of Gymnosperms (q.v.) and Dicotyledons (q.v.), in which a *cambium* zone, partly fascicular and partly inter-fascicular in origin, gives rise to rings of xylem internally, generally annually, and to phloem externally.

Grub Street, originally a street near Moorfields in London (now Milton Street), where many hack-writers and scribblers lived. The term thus

became applied to this class of persons in their collective capacity.

Grundtvig, NIKOLAI FREDERIK (1783-1872), was a Danish poet and politician. He was born at Udby, and educated at Aarhus, entering in 1800 the university of Copenhagen. He studied Icelandic, and, obtaining an appointment as private tutor, he turned his attention to Shakspeare, Schiller, and Fichte. He took orders, and wrote some controversial works, and took an active interest in politics prior to the war with Prussia. He came to England, and studied Anglo-Saxon, one result of this being the publication in 1840 of an Anglo-Saxon poem, *The Phœnix*, with a Danish translation. Others of his works are a treatise on the songs of the Edda, *Northern Mythology* (1808), *Decline of the Heroic Life in the North* (1809), *Songs for the Danish Church* (1837), and *Selections of Ancient Scandinavian Verse* (1838).

Grus, Gruidæ. [CRANE.]

Guacharo (*Steatornis caripensis*), a nocturnal fruit-eating South American bird, allied to the Goatsucker (q.v.). The total length is about 21 inches, plumage reddish-brown, deeper above, and marked with white spots, some of which are surrounded by a black line. These birds were discovered by Humboldt in 1799 in the cavern of Caripe, where they congregate in vast numbers. The young are slaughtered for their fat, which, when clarified, is used as butter, and will keep good for a long period.

Guadalajara. 1. A province and town of Spain in the northern part of New Castile. The province contains 4,800 square miles, and, with the exception of the north, where are some heights of the Guadarrama range, is somewhat level, and forms part of the basin of the Tagus, to which flow the Henares and other tributaries. The soil is mostly good, affording pastures on the uplands, oak and cork trees on the heights, and in the lower parts cereals and other crops—among the productions being silk, saffron, and flax. There is an export of sheep, wool, barley, wheat, oil, and wine. Iron is worked, and lead is produced in small quantity. The town, which is the capital of the province, is on a height near the Henares, which is crossed by a stone bridge whose foundations are of Roman construction. Guadalajara is 38 miles N.E. of Madrid, and is supplied with water from a Roman aqueduct. There are promenades, many churches and convents, a fine ducal 15th century palace, and a magnificent burial-place—Panteon—of the Dukes of Mendoza. Soap, earthenware, and woollen goods are manufactured. The name is said to signify "River of Stones."

2. A city of Mexico, 280 miles N.W. of Mexico, situated at a considerable height above sea-level, and enjoying a good climate.

Guadalquivir, an important river of Spain, well supplied all the year round with water from the Sierra Nevada. Rising in the province of Jaen, it flows S.W., through Cordova and Seville, and then divides Huelva and Cadiz, and falls into the Bay of Cadiz, forming in its lower course two

islands called respectively Isla Mayor and Isla Menor. Of its 374 miles of course, 80 miles, to Seville, are navigable. Cordova is another town on its banks. With the exception of rapids in its passage through the Sierra Morena, the stream is slow, and the neighbouring region low and swampy and liable to floods. Its tributaries are the Guadajoz and Genil on the left bank, and the Guadalimar and Guadiato on the right. It figures largely in poetry, as the typical river of Spain.

Guadeloupe, a West Indian island of the Lesser Antilles, 62 miles from Martinique, and about 4,000 miles from Brest. It is French territory. A salt channel, called "La Rivière Salée," from 100 to 400 feet wide, separates the island into two parts, Grande Terre and Basse Terre. The former of these is on the W., and has a length of 28 miles from N. to S., with a width of 12 to 15 miles. The latter is 22 miles N. to S., and 34 S.E. to N.W. By a curious contradiction in terms, Basse Terre is hilly and of volcanic origin, and rises to a height of 4,870 feet, and has many streams which are liable to sudden rises during the rain storms. Grande Terre, on the other hand, is flat, and water is scarce, the inhabitants having to rely upon the ponds for their supply. The temperature is generally pleasant, but the island is liable to heavy storms, and the rainfall is excessive. Among the productions are sugar, coffee, cotton, yams, bananas, and other tropical fruits, and there is some production of tobacco, vanilla, and cloves. The town of Basse Terre, situated in the southwest portion of the island, is the capital.

Guadiana (anciently Anas), a river of Spain and Portugal, called in its upper course Zancara, rises in the E. of the province of La Mancha, and flows S.W. to a series of lakes called "Ojos," and which were formerly regarded as supplying the main stream. Then taking the name of Guadiana, it flows W. to Badajoz, and then S., forming part of the frontier, then through the Portuguese province of Alemtejo, then again to the frontier, between Huelva and Algarve into the Bay of Cadiz. It is navigable for about 40 miles from the mouth, and its chief tributaries, all of which are on the left bank of the river, are the Javalon, Matachel, Ardila and Chanza.

Gua-hú (YA-HU), a primitive people of Camboja, close to the Siamese frontier, visited for the first time by Dr. Harmand in 1877. They are a timid, inoffensive people, quite distinct from the semi-civilised Bolovens of the same district; they still lead a purely nomad existence, and depend entirely on the produce of the chase.

Guaiacol, a compound of the aromatic or benzene series, which is found among the distillation products of "guaiacum" and of beech and other woods. It is hence one of the chief constituents of "wood tar" [CREOSOTE.] When pure it is a colourless liquid of specific gravity 1·12, which boils at 200° C. and possesses an aromatic odour. It has the composition $C_7H_8O_2$, its constitution being represented by the formula $C_6H_5(OH)OCH_3$, the

two radicals OH and OCH₃ being in what are known as the *ortho* position. [ISOMERISM.]

Guaiacum, a genus of tropical American trees belonging to the small order Zygophyllaceæ. The wood of *G. officinale*, a native of the West Indies and of northern South America, and to a less amount that of *G. sanctum*, a native of Cuba, Florida, and the Bahamas, is the *lignum vitae* of commerce, so named from its reputation as a drug. The heartwood is of a dark greenish-brown colour, and has a specific gravity of 1·333, and will therefore sink in water; it contains 26 per cent. of resin and is so hard and cross-grained that it cannot be split. The sapwood is pale yellow, will float, and contains no resin. The wood is used for ship-blocks, skittle-balls, mallets, string-boxes, etc. *Guaiacum resin*, which is glassy, brittle, greenish-brown, translucent, slightly balsamic and soluble in alcohol, is obtained as an exudation from the stems of these trees or by boiling the wood. It contains 70 per cent. of *guaiaconic acid* ($C_{38}H_{40}O_{10}$) and 10 per cent. of *guaiaretic acid* ($C_{39}H_{40}O_4$). It is adulterated with common resin and is used as an adulterant of jalap and scammony (q.v.). The wood was introduced into European medicine by the Spaniards in 1508, but the resin was not used until later.

The officinal preparations of this drug are the mixture (dose $\frac{1}{2}$ to 2 fluid oz.) and the ammoniated tincture (dose $\frac{1}{2}$ to 1 fluid drachm). *Guaiacum* is also a constituent principle of the well-known purgative pill known as Plummer's pill. The drug, when taken in small doses, is useful in cases of relaxed throat, and of chronic gout and rheumatism; if administered, however, in large doses it has a purgative action.

Guaicuri (GUACHIRES), a South American people, whose territory formerly comprised the north-east corner of Venezuela and the adjacent island of Margarita. They still form part of the environs of Cumana, but all now speak Spanish, and have in other respects conformed to civilised ways. They appear to have been of Carib stock, with a brown or coppery complexion. Humboldt spoke of them at the beginning of the 19th century as being, "next to the Caribs of Spanish Guiana, the finest race of men on the mainland." Several other tribes which used to bear the same name were formerly scattered over other parts of Venezuela and Guiana; but these all are now either extinct or merged in the general Hispano-American populations.

Guainares, an Indian nation of Venezuela, whose territory lies in the Upper Orinoco basin about the sources of the Matacuni and Padamo rivers flowing to the right bank of the main stream. Like their Guaharibo neighbours and several other tribes of this region, they are noted for their light complexion, hence grouped by the missionaries amongst the *Indios blancos*, or "White Indians." But the colour is not white, but rather a light yellowish olive, such as is prevalent amongst the southern inhabitants of Spain and Italy. (Humboldt, *Relation Historique*, viii.)

Guapiunavos, Venezuelan Indians of the Amazonas territory, on both sides of the Inirida which flows to the right hand of the Guaviare affluent of the Orinoco. The Guapiunavos were formerly a very powerful nation, ruling over nearly the whole of the vast region which now bears the name of Amazonas. Later their supremacy was disputed by the Maratibanos, who ascended the Cassiquiare from the Rio Negro, and in the struggle vanquished their renowned chief Cruseru. At present they are confined to the Inirida valley, where they bear the name of Puinabos, evidently a corrupt form of Guapiunevos. (Fr. Montolieu in *Bulletin de la Soc. de Géographie*, April, 1880.)

Guan, any bird of the genus *Penelope*, with fourteen species, ranging from Texas to Paraguay. They are large handsome game birds, closely allied to the Curassow (q.v.), from which they chiefly differ in having under the throat a patch of naked skin that can be inflated at will. They feed on insects, fruit, and berries.

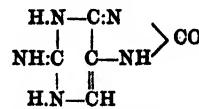
Guanaco (*Auchenia huanaco*), a South American ruminant, ranging in small herds over the Andes to Patagonia. It is the largest species of the genus, standing four feet at the shoulder, and is supposed to be the form from which the llama (q.v.) is descended.

Guanajuato, a province in the centre of Mexico, with an area of 12,500 square miles. It is mountainous in the north, but the south forms part of a fertile plain. It is very rich in minerals, gold, silver, copper, lead, and quicksilver being obtained. Some cattle are also reared, and woolen and cotton manufactures have been introduced by foreigners. The capital, of the same name, the centre of a large mining district, is a handsome town, and has among its public buildings the Alhondiga, or public granary.

Guanches. [CANARY ISLANDS.]

Guanidine, a compound of composition CN_3H_5 which may be obtained from *guanine* (q.v.) by the action of oxidising agents. It may also be prepared by numerous synthetic reactions which show its constitution to be represented by $\text{NH} : \text{C}(\text{NH}_2)_2$, so that it may be regarded as *urea* $\text{O} : \text{C}(\text{NH}_2)_2$, in which the oxygen is replaced by the group NH . It forms very soluble, deliquescent crystals, which act also as a strong base, combining readily with acids. A large number of compounds may be regarded as derived from guanidine, some of which are important physiologically; e.g. *creatine* (q.v.), *creatine*, and many of great chemical interest.

Guanine, a substance which derives its name owing to its abundant occurrence in guano. From this source it may be obtained by boiling with milk of lime, boiling the residue with soda and then treating the solution with (1) sodium acetate, (2) hydrochloric acid. It is thus obtained as a white insoluble powder which forms crystalline compounds with both acids and bases. It has the composition $\text{C}_5\text{H}_5\text{N}_5\text{O}$, and its constitution appears to be that represented by the formula



It is found in the pancreas of some animals, and is of much interest and importance owing to its close relationship to *uric acid*, *xanthine*, *caffeine*, and other animal and vegetable products.

Guano, the droppings of fish-eating birds on rainless or nearly rainless sea-coasts. Besides penguins, cormorants, and other birds, seals contribute to the formation of true guano, and the name "bat-guano" has been used for the accumulated dung of these animals which occurs in many caverns in various quarters of the globe. Humboldt brought guano from the Chincha Islands of Peru to Europe in 1804, and when Liebig called attention to its value as a manure in 1840 it became an important article of trade; but the South American sources of the supply have been largely exhausted. It is also obtained from the Angra Pequena islands, off the south-west coast of Africa, and from the Kuria-Muria islands, off the coast of Muscat. The value of guano as manure depends upon its richness in phosphates and nitrogen, the latter occurring as urates and ammonium salts which would be dissolved out by rain. It also contains an alkaloid *guanine* ($\text{C}_5\text{H}_5\text{N}_5\text{O}$). The nitrogen, reckoned as "potential ammonia," varies from 1 to 25 per cent., the phosphate from 6 to 56, and moisture from 11 to 17 per cent. Guano is an actively stimulating manure, tending to cause a great production of foliage and therefore useful for grass crops; but, mixed with superphosphate of lime, it is also valuable for flowering plants and roots. It is sold by analysis, at about £13 per ton for the best qualities.

Guaques, a South American people of Colombia, whose territory comprises the district of Cauqueta, state of Cauca, watered by the Cauqueta, Caguan, Putumayo, and other affluents of the Amazonas. This district is extremely productive, and the natives carry on a large barter trade with the surrounding civilised communities, exchanging wax, fish and other produce for hardware. The Guaques are still in a primitive state, fishers and hunters, living in wretched hovels of foliage, and wearing no clothes except the *fono*, a narrow loin-cloth worn only by the men. Amongst them also prevails the curious custom of the *curvada* (q.v.), which is practised by so many wild tribes in both hemispheres. (*Los Indianos del Andaiqui*, Popayan, 1855—English translation in *Bulletin of the American Ethnological Society*, New York, 1860–61.)

Guarana, or BRAZILIAN COCOA, is prepared from the seeds of *Paulinia sorbilis*, a native of northern and western Brazil, which, though much smaller, resemble those of the horse-chestnut, a member of the same natural order. They are ground into paste and dried into hard round balls. Guarana has a bitter astringent taste, and when grated into water and sweetened forms a favourite South American drink. It contains 5 per cent. of caffeine, or five times as much as coffee or maté, and more

than twice as much as tea; so that for medical purposes it may be regarded as impure caffeine. This alkaloid was previously to 1840 thought to be a distinct one, and was named *guaranine*.

Guarani, one of the great divisions of the American aborigines, who, with the closely allied Tupi of Brazil, occupy probably one-half of South America. According to some authorities, they form the substratum of the whole of the Brazilian populations, and their domain also comprises most of Paraguay, beside large tracts in Argentina, the Guianas, Venezuela, Bolivia, and Peru, with a total area of over 3,000,000 square miles, and a pure and mixed population of not less than 12,000,000. The Guarani language has even a still wider range, for it was adopted by the early missionaries as the base of the *lingua geral* or "general language," that is to say, the general medium of intercourse throughout the greater part of the continent. But the Guarini proper, that is, those bearing this name, meaning "warrior" or "painted" (comp., the expression "war-paint"), are not numerous even in Brazil, where they are represented only by various small groups numbering altogether not more than a few thousand souls. In several districts they have been settled by the Brazilian Government in *aldeias* (villages or reserves), where they cultivate a little land and occupy themselves with various house industries. These are all classed as *mansas* ("tame" as opposed to the wild tribes), and are for the most part nominal Christians. During the early days of the Portuguese occupation, numerous alliances were formed between the white settlers and the Guarani, whose descendants, the vigorous and enterprising *Mamelucos*, have done more than all the whites together for the exploration, conquest, and settlement of the inland regions of Brazil. [MAMELUOS.]

In Bolivia also, where the Guarani arrived towards the end of the sixteenth century, and where they occupy the spurs of the Andes in the provinces of Cochabamba and Tarija, their crossings with the Spaniards have produced a strong and handsome race whose language is generally, if not entirely, Spanish. Physically, the full-blood Guarani, those especially of Paraguay, where they still form the bulk of the population, and where their language is universally spoken, are characterised by short, stout figures, round face, low forehead, with slightly oblique eyes and a brownish-yellow complexion, giving them a distinctly Mongolic expression. Under the theocratic administration of the Jesuits in the famous Paraguay "missions" (1586-1767), their naturally peaceful and somewhat apathetic disposition degenerated into an abject spirit of obedience, of which the ruthless despot, Solano Lopez, took full advantage in the terrible war of the Triple Alliance (1862-70). The Guarani stock language presents some marked features that have been observed in few other native American tongues. It abounds in nasal gutturals and in monosyllables, which, like Chinese and the other members of the isolating family, change their meaning according to the tone with which they are uttered. (D'Orbigny, *L'Homme Americain*; Ruiz de Montoya, *Gramatica Guarani*.)

Guarantee, or **SURETYSHIP**, is an undertaking or promise to answer for the debt, default, or miscarriage of another person, and for which that other person remains liable. It is usually a simple contract, and the agreement or memorandum expressing or evidencing the transaction must, by the Statute of Frauds, be in writing, and must contain all the material terms, except that by a statute passed in the reign of Queen Victoria ("The Mercantile Law Amendment Act, 1856") the consideration for the guarantee need not be in writing. The guarantee may either be for one specified amount, or for any sum not exceeding that amount, or it may be a continuing guarantee limited or unlimited in amount. The surety under a guarantee has his remedy by action against the principal debtor, where such surety has been compelled to make a payment thereunder, and any one of several co-sureties who has paid more than his rateable proportion is entitled to claim contribution from the other or others of them. Persons holding offices or employments in the public service are frequently required to give security by means of sureties for the due performance of their duties. This subject is now regulated by "The Government Offices Security Act, 1875."

Guaraunos, the aborigines of the Orinoco delta and surrounding districts, reaching along the Guiana coast as far as the Essequibo river, and in Brazil to the Carupano district on the Paria coast. Both in speech and physical appearance they differ altogether from the neighbouring populations—having a rather broad face, low brow, large nose, abundant brown hair, scant beard, yellowish complexion. The account given of these natives by Humboldt on hearsay (*Relations*, vol. viii.) is greatly exaggerated. They do not live habitually on the tops of palm-trees, but in the districts subject to inundations raise their dwellings on platforms a little above high-water mark. They are skilled boatmen, and live more by fishing and hunting than by agriculture. (Level de Godas, *Official Report*, 1850; Michelena y Rojas, *Exploracion*, 1867.)

Guardian is one who has the care of the person or property of another confided to him. Guardians are appointed for the purpose of protecting the person, property, or rights of those who are supposed to be incapable of managing their own affairs—such as an infant or lunatic. They are of two kinds: (1) Guardians of the person or property, and (2) Guardians *ad litem* (i.e., to prosecute or defend an action). As to infants, an important alteration in favour of mothers has been effected by the "Guardianship of Infants Act, 1886," by which Act it is provided that the mother may, by deed or will, appoint a guardian after her own death and the death of the father of the children, to act jointly with the guardian (if any) appointed by the father. And the mother (if she survives the father) is constituted the guardian of her infant children generally, to act jointly with the guardian (if any) appointed by the father; but in such a case the court may associate one or more guardians with her. It is also now well settled

that the mother is the natural guardian of her illegitimate child. [POOR LAW, INFANTS, LUNATICS.]

Guards. The Guards are the choice troops of every army, and are generally more heavily armed than other soldiers. In the British army they form the garrison of London, and act as the sovereign's body-guard. They are termed the Household Brigade, and include both cavalry and infantry, the former consisting of the Life (Germ. *leib*, body) Guards and the Royal Horse Guards (about 1,200 men in all), and the latter of the Grenadier, Coldstream, and Scots Guards (5,000 men).

Guarini, GIOVANNI BATTISTA (1537-1612), a Ferrarese poet, was employed diplomatically by Alfonso II., of Ferrara, by Ferdinand de Medici, grand duke of Tuscany, and by the Duke of Urbino. His best work, *Il Pastor Fido*, written in imitation of Tasso's *Aminta*, enjoyed an immense popularity, and has been frequently translated. The author died at Venice.

Guatemala, the name of a Central American state and its chief town. 1. The *Republic of Guatemala* has Yucatan on the north, Mexico on the north-west, and Honduras and San Salvador on the south and south-east. It is bounded on the west by the Pacific, but has little coast on the opposite side, the state of Belize occupying half of the sea-line between Yucatan and Honduras. A large part of the country is yet unexplored, but the estimated area is 46,000 square miles, and the estimated population nearly one and a half millions. Guatemala was conquered in 1524 by a lieutenant of Cortez's, and remained under Spanish rule till the revolution in 1821. The present republic was founded in 1839 by Rafael Carrera, an Indian, who exercised dictatorial power till his death in 1865. From 1871 to 1885 General Barrios ruled, but after a period of firm government, during which Church property was applied to State uses and monastic orders suppressed, he fell in a war with San Salvador. Guatemala is extremely mountainous, and contains several active volcanoes, of which Fuego, more than 12,000 feet high, is the chief. Earthquakes are frequent and severe; sulphur and other hot springs are very numerous. There are many rivers and lakes, but in some parts water is often scarce. The climate is healthy, except on the Pacific coast, where yellow fever not unfrequently prevails. The soil is very productive, maize, beans, sugar, cocoa, tobacco, indiarubber, sarsaparilla, and coffee being raised from it, as well as several fruits and vegetables, and some wheat and rice. There are several hundred species of gorgeously-plumaged birds, and tropical insects from the most beautiful butterfly to the noxious scorpion and tarantula abound. Iguanas and turtles are also found in large quantities. The mineral resources of the country, as yet but partially developed, include gold and silver, iron, lead, quicksilver, zinc, and many other metals. The chief article of export is coffee, next in importance to which come hides, indigo, and sugar. Weaving

and the making of pottery and saddles are the chief industries; but a fourth of the annual revenue is said to be obtained from the government monopoly of *aguardiente*, a spirituous liquor. Great Britain supplies nearly a third of the imports. In 1879 primary education was made compulsory and gratuitous, and there are some good schools in the capital, Belén, Quetzaltenango, and other towns. Guatemala is governed by a President, elected for six years by *plébiscite*, with a council of thirteen, some of which are his own nominees. The Assembly is elected by universal suffrage. The Public Debt is large, but the security is good. The chief towns of Guatemala besides the capital are Quetzaltenango, Chimaltenango, and the part of San José.

2. *Guatemala La Nueva*, the capital, is called "the new" to distinguish it from two other towns of the same name. It is situated on the S.W. of the Republic nearly 5,000 feet above the level of the sea, from which it is distant some 70 miles. It is well built and provided with all modern improvements, and contains numerous educational institutions supported by the state, as well as a cathedral, several hospitals, and two large markets. There is also a bull-ring and a subsidised theatre. Guatemala is a great centre for foreign trade. The inhabitants of Guatemala, most of whom are still nearly pure Indians, descendants of the five civilised peoples (Quichés, Cachiques, Zutugils, Mam or Pokomans, and Pipiles) who at the time of the conquest occupied this region together with the present Mexican states of Chiapas and Soconusco, and the greater part of Central America as far as Chiriquí Bay. The Pipiles were comparatively recent intruders from the Mexican plateau, and many of them even still speak the Aztec language; but all the rest, as well as the less cultured Chols and Lacandones of the department of Vera Paz on the Mexican frontier, are members of the widespread Maya-Quiché family, whose domain included the whole of Yucatan and parts of Mexico as far north as the states of Vera Cruz and Tamaulipas. [MAYAS, QUICHÉS.] In Guatemala the Indians, although three or four times more numerous than the Creoles and half-castes, are still regarded as an inferior race scarcely entitled to the rights of citizenship. Very few are owners of the land they cultivate, and the great majority are held in a state of servitude almost worse than slavery to the planters and the money-lenders whose advances they are unable to redeem. Crossings between the whites, negroes, and aborigines have produced a great variety of types, showing every shade of transition from the European to the Indian and African. These half-breeds are all of Spanish speech, and are politically the dominant element. (Squier, *The States of Central America*; Adolf Bastian, *Die Culturländer des alten Amerika*.)

Guatusos (PRANZOS), Indians of Central America, who occupy the basin of the Rio Frio in Costa Rica. Several geographical features of this region—plains, mountains, and rivers—are named from the Guatusos aborigines, who have hitherto kept almost entirely aloof from all contact with the whites, and have consequently preserved their

usages, language, and traditions more perfectly than perhaps any other native race. They allowed no strangers to penetrate into their territory, and the most extraordinary reports were long current regarding their appearance, customs, and origin, some supposing them to be descended from some English mutineers under Drake, who after the capture of Esparza took refuge in the Merivalles forests, killed all the men of the Pranzos tribe, and formed unions with the women. They were said to be much above the average height and to have red hair and blue eyes; but little was known of them beyond what had been gleaned by the few missionaries who have endeavoured to establish relations with this mysterious people. Lately, however, they have begun to visit the markets in the settled districts, even bringing offerings to the priests, "brothers of the sun." These show no trace of European blood, being of a dark brown complexion, with black hair and high cheek-bones, like the Chontals of Nicaragua, of whom they are probably a branch. So far from being fierce savages, as was formerly believed, they are peaceful agriculturists who have suffered much from the Ladinos invading their forests in search of rubber. (Franz in *Petermann's Mittheilungen*, 1862; Squier; Thiel; Reclus, vol. xvii.)

Guava, the fruit of *Psidium Guayava* and other species, small trees of tropical America belonging to the Myrtle family. The fruits vary very much in size, shape, and colour, the most valued being the "white guava" (var. *pyrifera*), with pear-shaped, yellow or whitish fruits the size of a hen's egg. The inferior "red guava" (var. *pomifera*), which is more apple-shaped, is also used in preparing *guava-jelly* and *guava-cheese*, which preserves, owing to the perishable character of the fruit, are the only forms in which the fruit is imported into England. The tree has been naturalised in the East, and thrives in English hothouses.

Guayanas, Indians of Paraguay, who occupy the rivers flowing to the right bank of the Parana, between lat. 25° and 26° S. They are a peaceful tribe, living partly by agriculture, partly by the chase. The Guayanases are members of the Guarani family, as is evident from their appearance and from the specimen of their language published by Lieut. D. Patifio, in the *Bulletin de la Soc. de Géographie*, August, 1868.

Guayaquil, the chief port of Ecuador, South America, stands on a peninsula at the head of the Bay of Guayaquil. The town, first founded in 1537, was not removed to its present site till a century and a half later. It is built chiefly of bamboo and is hot and unhealthy. Cocoa is the chief article of export, and straw hats and hammocks are made. There are also saw-mills and machine-works. A railway has now been extended many miles into the interior. The trade is almost entirely in foreign hands, about half being carried on by the British.

Guaycurus, South American Indians, whose territory lies mainly in that part of Gran Chaco, between the Paraguay and the Pilcomayo rivers, which, since 1876, has been included in the republic

of Paraguay. Tribes of this name are also met in the province of Matto Grosso, Brazil, and the people of Paraguay apply the term Guaycuru in a general way to all the Tobas and Lenguas, who constitute a large section of the wild tribes of Gran Chaco. All are probably branches of the Guarani family.

Guben, a town in Prussia on the river Neisse, 28 miles south of Frankfort-on-the-Oder. It suffered much during the religious wars of the 15th and 17th centuries. The making of hats and cloth goods are the chief industries.

Gubernatis, COUNT ANGELO DE, a versatile Italian writer, was born in 1840 at Turin. He studied under Bopp and Weber at Berlin, and was appointed professor of Sanskrit at the Institutio dei Studie Superiore, Florence, in 1863. In 1872 he published at London his *Zoological Mythology*, which was followed in 1878 by the *Mythologie des Plantes* (Paris). As a biographer he has written upon Manzoni, Giovanni Prati, and other Italian men of letters, and has given to the world the *Storia Universale della Litteratura* (1882-85), and a *Biographical Dictionary of Contemporary Writers* (1879-80, French ed. with suppl. 1891). He has also written successful plays, in which Rossi appeared, and founded five journals. In 1878 he lectured on Manzoni at Oxford. He married a daughter of Bakunin.

Gudgeon (*Gobio*), a European genus of small carp-like fishes, from clear rivers with gravelly bottom. The scales are of moderate size; the spineless dorsal is short. There is a barbel at the angle of the mouth, and the pharyngeal teeth are in two rows. *G. fluviatilis*, the common Gudgeon, about 8 inches long, olive-brown, spotted with black above, white below, is British. The only other species, *G. uranoscopus*, is found in the Danube and Dnieper, and their affluents, Ladisлавia and Pseudogobio from Eastern Asia, are closely allied.

Gudrun, an old German epic poem, dating probably from the 12th century, was translated into modern High German by Simrock. Its authorship is unknown. Gudrun, from which the poem takes its title, is the daughter of Hettel, King of the Frisians. She is carried off by Hochmut, son of the Norman dake, in whose country she undergoes great sufferings, but refuses to break her troth to Herwig of Zealand, who ultimately comes and rescues her.

Gelderland, or GELDERLAND, a Dutch province, having Germany in the S. and E., Overyssel in the N., and the Zuyder Zee on the W. It is in area 1,957 square miles. It is not so flat as some parts of Holland, and is indeed in many places quite picturesque. It enjoys a healthy climate and possesses a fertile soil from which wheat, rye, and tobacco are largely raised. The chief rivers are the Rhine, on which stands Arnheim, the capital, the Yssel, on which are Deventer and Kampen, the Waal, and the Maas, which forms the southern boundary. The present province was formed out of the old duchy of Gueldres, which for several centuries enjoyed practical independence, which lasted even after it had become Hapsburg property in 1483.

In 1543, however, it became part of the Austrian Netherlands. In the War of Independence its sympathies were divided, the northern part alone taking part with the insurgents. In 1814 the old duchy was divided between Prussia and Holland.

Guelder-rose, the garden name of the cultivated variety of *Viburnum Opulus*, a tree belonging to the Honeysuckle family, in which all the flowers in the cymose clusters are neuter and have the corolla much enlarged in lieu of the absent essential organs. In this variety, introduced into cultivation from Guelderland, these corollas, each three-quarters of an inch across, are massed into a globous inflorescence, whence the tree is popularly known as the Snow-ball Tree. The wild form of the species, in which only the outer flowers are neuter and have enlarged corollas and the inflorescence is flat, is known as Water Elder, flourishing by the water-side. Its opposite leaves are irregularly three to five-lobed and turn red in autumn, and its fruits are elliptical translucent blood-red berries; so that, unfortunately, both in summer and autumn branches are torn off for sale in the streets of London. The cultivated tree flourishes in the clayey soil of gardens near London. The name Mealy Guelder-rose is a book name for *V. Lantana*, a shrub common on calcareous soils and also known as Wayfaring Tree. Another allied species is the Laurustinus of our shrubberies (*V. Tinus*).

Guelfs and **Ghibelins**, the names given to the two contending parties which divided both Italy and Germany in the Middle Ages. They became party designations in consequence of their use as war-cries at the battle of Weinsberg in Suabia (1140) between Henry the Lion, Duke of Saxony, and Conrad of Hohenstaufen, Duke of Franconia, afterwards the first of the Swabian Emperors. Welf was the name both of the founder of the house and of Henry the Lion's brother, while Waibling was a village in the territory of the Hohenstaufen, in which Conrad's brother, Frederick, had been brought up. The forms Guelfi and Ghibellini were due to the Italian mode of pronunciation. As a general rule, the Guelfs supported the authority of the Popes, the Ghibelins that of the Emperors; but amid the confusion of political strife these principles were sometimes lost sight of, and the struggle became merely one of personal ambition. The Guelf party included many of the free cities of Northern Italy, which sought protection against the encroachments of the Emperors, but the leading cities were regarded with much jealousy by the others, and there was often a standing feud between two neighbouring cities, so that for each Guelf community there was generally one or more on the side of the Ghibelins. Of the great families those in the north generally adhered to the Ghibelins, those of Central and Southern Italy to the Guelfs. Many of the cities, as well as the nobles, constantly changed sides, according to the exigencies of the moment. The feud practically came to an end in the fourteenth century. The present royal family of Great Britain are descended from the house of Welf, through Ernest Augustus, Duke of Hanover (son of

George, Duke of Brunswick-Lüneburg), who married Sophia, daughter of James I. [DANTE.]

Guercino, "the Squint-eyed," is the name by which GIAN FRANCESCO-BARBIERI, a Bolognese painter, is commonly known. He was born at Cento about 1590, and died at Bologna in 1666. He painted in several styles, but the dominant influence with him was that of Caravaggio. After visiting Rome and Venice, he finally settled down to a prosperous career at Bologna in 1742. Among his finest works are *St. Petronilla* (Capitoline Gallery), and the *Death of Dido* (Spada Palace), at Rome, and *Angels Weeping over the Dead Body of Christ*, in the National Gallery, London.

Guericke, OTTO VON (1602-86), a Prussian natural philosopher, was born at Magdeburg, and died at Hamburg. He invented the air-pump in 1650, and experimented with it before the Imperial Diet at Ratisbon four years later. He also made some discoveries in electricity. During his life he visited Holland, France, and England.

Guerrillas, properly troops of predatory skirmishers, but now always used of the single members of such a troop. The Spanish *guerrilleros* were bands of peasants and shepherds who embarrassed the French armies in the war of 1808-14 and afterwards played a prominent part in the Carlist and other civil wars.

Guérin, GEORGES MAURICE DE (1810-39), a French poet of great promise, was born at La Cayla, Languedoc, of noble family. He was educated for the Church at Toulouse and Paris, and in 1832 joined the monastic society of Lamennais at La Chenâie in Brittany. After Lamennais left, Guérin went to Paris, where he taught at the Collège Stanislas, and contributed to the journals. In 1838 he married a Creole lady, but died of consumption in the following year in his native province. He left two poems, *Le Centaure* and *La Bacchante*, which in 1862 were published with his letters and journals. He attracted the attention of Georges Sand and Sainte-Beuve, and there is a well-known essay by Matthew Arnold on Maurice and Eugénie de Guérin. The latter devoted her life to her brother, whom she survived nine years only.

Guernsey, one of the Channel Islands, about 23 miles from the French coast and 65 from Start Point, has an area of 28 square miles. The climate is excellent, and large quantities of fruit and vegetables are exported, as also grey and some red granite. Port St. Pierre, the chief town, has a good harbour, a school founded by Queen Elizabeth with scholarships to Jesus, Exeter, and Pembroke Colleges, Oxford, a thirteenth-century church, a ladies' college, and a good market. Guernsey is the residence of a Lieutenant-Governor, and has a somewhat oligarchical constitution. The land is mostly held by "peasant proprietors," and the old Norman law prevails. Pop. (1901), 40,477.

Guerrazzi, FRANCESCO DOMENICO (1804-73), Tuscan patriotic writer, was born at Leghorn. When the Grand Duke fled from Tuscany in 1849,

he, then a Minister, became a member of the provisional government, of which he held the almost absolute direction until the return of the prince. He was now imprisoned for three years on a charge of conniving at the revolution, although he had done his best to preserve the continuity of government, and was afterwards to be sent to the galleys for life. The sentence was changed to one of banishment, but after a few years Guerrazzi returned from Corsica and sat in the parliament at Turin. Chief among his works were his *Apologia* (1857), and the historical novels *La Battaglia di Benevento* (1827) and *L'Assedio di Firenze* (1836).

Guesclin, BERTRAND DU, a great French general, was born in Brittany about 1320. He distinguished himself in the Brittany Succession War as a partisan of Charles de Blois, and during the Hundred Years' War was the only French leader who equalled the great English captains. He gained some successes while King John was a prisoner in England, and before the accession of Charles V. had driven the enemy from the heart of the kingdom. In 1364 he defeated Charles the Bad of Navarre at Cocherel, but in the autumn of the same year was himself defeated and captured by Sir John Chandos at Auray. After his ransom he led the army of Henry of Trastamare against the Black Prince, who supported Pedro the Cruel. The result of the battle of Najera, or Navarette, was that Du Guesclin was again a prisoner (1367). Having been ransomed, he nevertheless again met Don Pedro, and this time defeated him at Montiel and gave the crown to his brother and foe. Soon after this he was made Constable of France, and brought his career to a glorious end by gaining back almost the whole of his country from the English.

Gueshtulas, a group of nine confederate Berber tribes chiefly in the Great Kabyle uplands, Algeria, with a collective population of nearly 20,000. By some writers the term *Gueshtula* has been identified with the *Getuli* of antiquity. The Getuli occupied a vast domain in Mauritania, mainly south of Numidia; but they were broken and dispersed in various directions by the great Arab invasion of the eleventh century, and some of their tribes may still be represented by the Bu-Addu, Bu-Gherdān, Kufi, Shurfa, and the other members of the Gueshtula confederacy in Algeria.

Guest, EDWIN (1800-80), a Cambridge antiquary, was eleventh wrangler in 1824, and afterwards successively fellow and master of Caius College. In 1841 he was elected F.R.S. He was author of a *History of English Rhythms* (1838), *Origines Celtioae*, and similar works, which were valuable in their day, which, however, was before the scientific treatment of historical subjects had become usual.

Guetarnia, a Berber people of the province of Oran, Algeria. There are two divisions, Guetarnia Fuaga and Tahhta ("Upper" and "Lower" Guetarnia), the former in the uplands between the Sig and Habra rivers, the latter on both banks of the Sig above Saint Denis.

Gueux ("BEGGARS"), the name adopted by the league of nobles formed in 1565 to resist the introduction of the Inquisition into the Netherlands by Philip II. of Spain. The name was originally applied to them in contempt. Their efforts were unsuccessful; but the naval war instituted by a branch of the confederacy who called themselves the "Beggars of the Sea" ultimately resulted in the independence of the Netherlands (1648).

Guevei (*Cephalophus pygmaea*), a small South African antelope, not much bigger than a rabbit.

Guglielmi, PIETRO (1727-1804), an Italian composer, was born at Massa di Carrara. After giving successful performances in the chief cities of Italy, he visited Dresden and other places in Germany, and remained five years in London. In 1777 he came to Naples, and in 1793 was made maestro di cappella by Pope Pius VI. Among his operas were *La Didone*, *La Serra Inamorata*, and *La Bella Pescatrice*.

Guiana, a region in the N. of South America, lying between Venezuela and Brazil, two provinces of which are also known by this name. What is ordinarily known by the name is the threefold tract of country, consisting of British Guiana, Dutch Guiana, and French Guiana. This country is well watered by numerous rivers, which are, however, only to a slight degree navigable, having numerous cataracts in their courses, mud-banks at their mouths, and sand-banks in their channels. The climate is hot and moist, and the rainfall heavy, especially in southern, or French Guiana. Vegetation is luxuriant, and a large quantity of timber is obtained. Gums, bark, nuts, balsams, cotton, tobacco, caoutchouc, and many plants useful for medicinal purposes are found in abundance, and of edibles, arrowroot, tomatoes, guava, cassavas, rice, yams, and many different fruits are indigenous. Besides ferns and tree-ferns, there are orchids growing along the tops of the trees, and the Victoria regia lily. The Spaniards first came to Guiana in the first years of the 16th century, and in this and the succeeding centuries several expeditions in search of gold and the fabled El Dorado landed in the country, notably the disastrous one of Sir Walter Raleigh. The Dutch were the first to really effect a settlement on the Essequibo in 1613; the English came to Surinam in 1650; and lastly the French arrived. The British tried to seize the whole country, but in 1667 gave up Surinam to the Dutch in exchange for what is now New York. A few years later the French came to Cayenne, farther south, where they have remained ever since. At the peace of 1814 Surinam, which had been captured in the war, was again given back to the Dutch, but all the other conquests, comprising the north of Guiana, were retained by Great Britain.

British Guiana, or Demerara, has Venezuela and Brazil on the W. and S., Dutch Guiana on the E., and the Atlantic on the N. The exact line of the Venezuelan boundary was settled in 1899. The country has an estimated area of 90,800 square miles, with 320 miles of coast. In

the W. there are several chains of mountains, that of Roraima reaching from 8,000 to 9,000 feet. The chief rivers are the Berbice, the Demerara, and the Essequibo, which names are also given to the three counties into which British Guiana is divided. The chief towns are Georgetown, the capital, and New Amsterdam. Sugar is much grown and largely exported, and the chief other industries being wood-cutting and gold-mining. Chinese and coolies are chiefly employed in the plantations. The administration is in the hands of a governor, assisted by a Court of Policy of 15 members, 8 of which are elected by the people. Taxation is levied by a court consisting of the Court of Policy and 6 members elected by popular vote. The Executive Council consists of the governor, 4 official and 2 unofficial members nominated by the Crown.

Dutch Guiana, or Surinam, has an area of 46,085 square miles and a coast-line of 240. It is separated from Brazil on the S. by the Tumuc-Humuc Mountains, and from French Guiana, on the W., by the river Maroni. Very little of the country is cultivated, the greater part of it being still primeval forest. Sugar and coco are, however, grown and exported, and gold-mining has increased of late years. In 1887 new mines were discovered between the Tapanari and Arva rivers, a district claimed both by the Dutch and the French. The capital is Paramaribo. The legislative body is elected by the people, and the executive consists of a governor and council.

French Guiana, or Cayenne, lying between Dutch Guiana and Brazil, has an area of about 31,000 square miles. There is a coast-line of about 240 miles. The chief rivers are the Maroni, the Sinnamary and the Oyapok, on the Brazil boundary. There are a few ranges of low hills. Very little commerce is carried on, but some gold is obtained from the mines and exported, some also being smuggled. The climate is extremely unhealthy, malarial fever and dysentery being prevalent. During the French Revolution some of the Terrorists, including Billaud-Varennes and Collot d'Herbois were despatched to Guiana, and later on some who deserved a better fate. From 1853 to 1864 an unsuccessful attempt was made to form French Guiana into a penal colony. Slavery was not abolished here till 1848. To the N.W. of Cayenne are the îles de Salut, between which and the town there is a good roadstead.

Guicciardini, FRANCESCO (1482-1540), an Italian writer and statesman, was a native of Florence, where he was in early life a professor of law. He won his reputation as a diplomatist by his mission to Bruges in 1512, and in 1518 was named governor of Modena and Reggio. In 1521 he drove the French from Parma, and was subsequently governor of that state, the Romagna, and Bologna. In 1534 he left the Papal service, and began to take part in the affairs of Florence, where he took a leading part in the restoration of the Medici and was a member of the Commission of Twelve. From 1534 till his death he withdrew from public business and devoted himself to the composition of his *Storia d'Italia*, which described

the course of affairs between 1494 and 1532 in a critical spirit, but in a prolix style. His *Maxims* have been more popular.

Guide Bars, in a steam-engine, gas-engine, or other similar motor, are parallel bars along which the cross-head of the piston-rod may slide. The rectilinear motion of the piston-rod is to be converted into a rotatory motion of the shaft by means of the connecting rod. One end of this must travel in a straight line, the other end in a circle. The guide-bars provide the constraint in the first case, the crank the constraint in the second.

Guido Aretino, of Arezzo, a Benedictine monk, who is credited with the invention of counterpoint, flourished in the 11th century. Experts consider it certain that he designed the construction of the stave, and probable that to him is due the discovery of the hexachord, solmisation, and the Harmonic Hand. Guido, who was invited to Rome by two Popes, left works entitled *Micrologus* and *Antiphonarium* on musical theory.

Guido Reni, who is usually known as **GUIDO** (1575-1642), the great Bolognese painter, was born at Calvenzano, near Bologna, his father being a music master. He was placed in the studio of the Caracci, and took lessons in fresco-painting from Ferrantini. In his early period, to which belong *The Massacre of the Innocents* and the *Pietà* in the Bologna Gallery he was under the influence of Caravaggio. In 1596 he went to Rome, and studied the work of Raffaelle. He remained under the spell of that master in his second period, to which belong his *Aurora Preceding the Chariot of the Sun* (in the Palazzo Rospigliosi at Rome) and his unfinished *Nativity* in San Martino, at Naples. During his third period he modelled himself in the art of classic antiquity and attained great delicacy, but lost warmth. Among Guido's pupils were many of the best Bolognese painters, among whom was "Il Pesarese" (Contarini), whose portrait of his master is at Bologna. The Louvre, the Dresden Gallery, and the Museo at Madrid are especially rich in Guidos. There is one at Hampton Court, and the National Gallery has a *Coronation of the Virgin* in his early manner, three in his second and best, and two in his last.

Guienne, an ancient province in S.W. France, now divided into the departments of Gironde, Dordogne, Lot, and Aveyron, with parts of Lot-et-Garonne and Tarn-et-Garonne. It was at one time closely connected with English history, being brought by Eleanor as part of her dowry on her marriage with Henry II.

Gnignet's Green is a green powder obtained by strongly heating a mixture of boric acid with potassium bichromate, and treating the resulting mass with water. It has the composition $\text{Cr}_2\text{O}_5\text{H}_4$ ($\text{Cr}_2\text{O}_3 \cdot 2\text{OH}_2$), and is very largely employed as a pigment.

Guilds, or, more properly, *Gilds*, were associations formed for various purposes during the Middle Ages. They have been variously derived from the Roman *collegia opificum* (colleges of artisans) and

the assemblies of the Teutonic tribes and families at their great sacrificial feasts, but the true view seems to be that they grew naturally out of the circumstances of the time, associations of a more or less voluntary character taking the place of the organisations of the tribe and family as the basis of social life. The Anglo-Saxon word *gild* has various meanings, including "tax" or "payment," "sacrifice," and "worship." Perhaps the associations were called gilds because they were maintained by the joint contributions of the members. During the Anglo-Saxon period we read of *frith gilds*—associations for mutual protection at a time when there was no efficient central authority—and *religious gilds*, which concerned themselves with the spiritual welfare of their members both in this world and in the next. At this stage, however, and to some extent at a later period, the secular gilds also were, more or less, religious societies, and throughout their whole history the convivial element, which displays itself in constantly-recurring banquets, is a very striking feature. Soon after the Conquest we hear for the first time of the *gilds merchant*. They are intimately connected with the royal charters which conferred on the privileged towns the right of managing their own affairs, subject to a fixed annual payment. Speaking generally, the gild merchant may be described as the corporate body of citizens, in so far as the activity of the latter was confined to matters of industry and trade. The two bodies, however, were not necessarily identical; a member of the gild was not always a burgher, nor a burgher a member of the gild. Although the gilds were very jealous of their privileges, and endeavoured to keep the trade of the town in their own hands, they often found it to their advantage to admit neighbouring lords and their tenants, and even traders living at a considerable distance. Moreover, many charters contain no mention of a gild, which shows that it was not regarded as an essential element in the town constitution. Economic progress resulted in the division of industry; the man who had hitherto been at once weaver, fuller, and dyer, now followed only one of these trades. This change led to the formation of the *craft gilds*, for it was often found convenient to allow those engaged in some one branch to regulate the methods of production and other matters connected with the craft. Many of the functions of the gild merchant were thus gradually absorbed by the craft gilds. On the Continent these gilds became very powerful, and their dissensions with the constituted authorities gave rise to much social disturbance; but in England this was impossible, owing to the restraining influence of the royal authority. The English craft gilds possessed no independent jurisdiction; many matters closely connected with industry, such as the regulation of wages and prices, were regarded as outside their province, and in their ordinances they were obliged to follow the lines laid down in the enactments of the civic authorities and the statutes of the realm. Within these limits the gilds supplied an efficient machinery for carrying out the policy which seemed conducive to the welfare of society at large. The aim of industrial

legislation at this period was not to promote the increase of wealth, but to ensure the security and well-being of every member of the community, regarded as a separate individual. Like all mediæval associations, the whole gild was responsible for the conduct of each of its members. It might, therefore, be entrusted with what was the chief object of care, the protection of the ignorant and unwary consumer. The gild-wardens visited the workshops to see that goods were honestly and skilfully made, and when finished they were to be sold in the open market, where there was no opportunity for over-reaching or fraud. Besides master-workmen, the gilds included apprentices and journeymen. Rules concerning apprenticeship are numerous in the gild-statutes, but they do not appear to have any specially economic significance. A period of probation was always necessary before joining an association, and this would apply to the gilds as well as the other bodies, since they were responsible both for the efficiency and the good behaviour of the craftsmen. The enforcement of a term of apprenticeship and the restriction of the number of apprentices allowed were certainly not intended to raise the profits of the gild by limiting the number of workmen. The gilds did make some attempts to legislate in their own interests, but they were speedily checked by the royal justices. The mutual relations of the gild-brethren, although of secondary importance, must not be entirely overlooked. Allusion has already been made to their convivial gatherings, but they showed their fellow-feeling to better purpose by maintaining their own sick and poor. There was no necessity for a poor-law in the Middle Ages. The expansion of English commerce during the latter part of the fifteenth century rendered the gild system an inadequate method of industrial organisation. At the same time, the gilds—which had now in many cases acquired a share in town government—tended to become narrow and exclusive bodies, under the management of the richer members. The result was that industry drifted away from the towns to new centres in the country, where it was conducted on different principles. The confiscation of the gild lands by Henry VIII. and Somerset hastened on their decline. The London gilds still survive in the City Livery Companies, and there are many gilds in connection with religious bodies.

Guildford, the capital of Surrey, is a parliamentary and municipal borough 31 miles S.W. of London by rail. It is picturesquely situated on a slope of the chalk downs, beneath which runs the Wey, the High Street terminating in an old bridge with five arches. Of the ancient Norman castle little now remains excepting the lofty and massive square keep. The castle precincts are tastefully laid out as a public recreation ground. The High Street is lined by some fine old buildings, including the Guildhall (1687), King Edward VI.'s Grammar School, and Trinity Hospital, founded in 1619 by Archbishop Abbot for twenty aged persons, in the chapel of which there is some good stained glass. Near the High Street is the interesting Norman church of St. Mary, which has two

apsidal terminations. There is a trade with London in grain, timber, and malt. Pop. (1901), 15,937.

Guillemot, any bird of the genus *Uria*, of the Auk family (*Aleidae*), with eight species, representing in arctic and temperate regions the Penguins of the antarctic seas. The sharp bill is of moderate length, the wings and tail are short, the legs are placed so far back that the birds on land assume a nearly erect position, and their walk is ungainly; the hinder toe is absent, and the three toes in front are connected by a membrane. They swim and dive with great facility, using the half-opened wings as paddles in the latter process, but the flight is heavy. They feed on crustaceans and fish-fry, and are eminently social, breeding together in large companies. The single pegtop-like egg is deposited on the bare cliff, and the male shares in the duties of incubation and the care of the young. The Common, or Foolish, Guillemot (*U. troile*), about eighteen inches long, is abundant all round our coast. The plumage is dark brown above, the lower part of the neck in front and all the under surface is white in summer, and in winter the white spreads to the head. The eggs taken at Lundy are sent to Bristol for clarifying wine, and many of those taken on the Yorkshire coast are used in Leeds in the preparation of patent leather. *U. brunnichii*, doubtfully British, has a stouter bill and the secondaries tipped with white, so as to form a bar across the wings. *U. grylle*, the Black Guillemot, is smaller than the common species, has the summer plumage deep black glossed with green and a white patch on the wings.

Guillotine. (1) An instrument used in France for decapitating condemned persons. It was introduced by the Convention in 1792, and many thousands perished by this means during the first Revolution. It is named after Dr. J. I. Guillotin, who in 1789 had proposed the adoption of some more merciful method of execution; but the actual inventor is said to have been a Dr. Louis, from whom the instrument was at first termed a *louisette*. (2) In metallurgy, a large iron weight which, by being allowed to fall from a height, is employed for breaking up iron plates.

Guinea, a gold coin current in England from 1663 to 1813. After several changes, the value was finally fixed at twenty-one shillings. It was so called because it was originally coined from gold which came from Guinea in Africa.

Guinea, a portion of the west coast of Africa, the limits of which have never been precisely determined. Approximately, it may be said to extend from Cape Verga in lat. $10^{\circ} 30' N.$ to Cape Negro in lat. $16^{\circ} S.$ It is divided into Upper and Lower Guinea, on the northern and eastern sides of the Gulf of Guinea respectively. The former includes Sierra Leone, Liberia, the Ivory Coast, the Gold Coast, the Slave Coast, and the Cameroons, the latter the Gaboon Colony, the Congo Free State, Angola, and Benguela. In the neighbourhood of the coast the climate is extremely unhealthy, owing to the shallow lagoons which are separated from the sea by narrow ridges of sand. Farther

inland the surface rises through a series of gradually ascending plateaux to the level of the African table-land.

Guinea, GULF OF, a large bay on the west coast of Africa, lying between Cape Palmas on the N.W. and Cape Lopez on the S.E.

Guinea-corn. [DURRA.]

Guinea Fowl, any bird of the African genus *Numida* of the Pheasant family, with nine species ranging over the continent and eastward to Madagascar. There is a warty membrane at the base of the short stout bill, the lower mandible is wattled, and the head bears a horny casque (as in the domesticated species) or a feathered crest. The plumage is bluish-grey, thickly spotted with white, which is generally the colour of the outer quills. *N. meleagris*, the Common Guinea Fowl, is well known as a domesticated bird. It is about the size of a hen, and its flesh and eggs are in high esteem. The cry is harsh, and somewhat resembles the words "Come back!" uttered sharply. Guinea fowl are naturally monogamous, but they are said to do best in domestication when one cock is kept to two or three hens.

Guinea Green, a dark green dye, which appears of the same colour by artificial light. It has a very complicated formula, being the sodium disulphonate of diethyl-dibenzyl-diamido-triphenyl-carbinol, and is closely related to *rosaniline*, *malachite green*, and very many other dyestuffs.

Guinea-pig, a popular name for any species of the Rodent genus *Cavia*, involving an error in each word, for they are natives of South America, not of Africa, and are in no way related to the swine. They are timid rabbit-like animals, with short limbs bearing four toes on the front and three on the hinder pair; the ears are short, the lip is not cleft, and the tail is rudimentary or wanting. The Restless Cavy (*C. aperea*), from which the domesticated form (*C. cobaya*) is probably derived, and from which the latter differs little except in its varied colouring, lives in small companies on the banks of the La Plata, ranging northwards as far as Brazil. The great plains of South America are the home of allied species. Other forms are the Bolivian Cavy (*C. boliviensis*), the Rock Cavy (*C. rupestris*) from Brazil, and the Southern Cavy (*S. australis*) ranging to Magellan Straits.

Guinea-worm (*Filaria medinensis*), belongs to the order *Nematoda* or Threadworms. The adult form lives beneath the skin of man and, more rarely, of the horse; it occurs in the tropical parts of Africa and Asia, occasionally also in the West Indies. A length of six feet is sometimes reached. Very numerous living young are produced, escape from their host and, for a time, swim freely in fresh water; they then bore their way into the body of a small crustacean, Cyclops, where they undergo further development, but the sexually mature condition is only attained when the Cyclops is swallowed by a man or a horse, through whose tissues the young worms make their way to a position beneath the skin, usually of the feet or legs.

Guinness, Sir Benjamin Lee, Bart. (1798-1868), belonged to the well-known Dublin brewing firm established in 1759. In 1865 he defrayed the entire cost of restoring St. Patrick's Cathedral. He was created a baronet in 1867. His eldest son **ARTHUR EDWARD** (b. 1840) was raised to the peerage as Baron Ardilaun in 1880. His third son **EDWARD CECIL** (b. 1847), who has expended large sums in erecting sanitary workmen's dwellings in London and Dublin, became Baron Iveagh in 1891.

Guisard, Robert (1015-85), was the sixth son of Tancred, Lord of Hauteville, in Lower Normandy. Enterprise and the love of adventure led him to join his elder brothers William, Drogo, and Humphrey, in South Italy. By his daring courage he greatly contributed to the Norman victory at Civitella (1053). In 1054 he became President and first count of the aristocratic republic of Apulia, an office which had been held by his three brothers successively. In 1060 Pope Nicholas II. granted him the title of duke. The territory over which he ruled was conterminous with the subsequent kingdom of Naples, including the Greek provinces of Calabria and Apulia, the Lombard principality of Salerno, the republic of Amalfi, and the inland dependencies of Beneventum. In the course of the same year he entrusted his younger brother Roger with the conquest of Sicily, a task which it took thirty years to accomplish. In 1081 he and his son Bohemund began a series of invasions of the Eastern Empire, terminated only by his death in the island of Cephalonia.

Guise, the name of a celebrated family of French dukes, who took their title from the town of Guise (q.v.). **CLAUDE DE LORRAINE** (1496-1550), the first duke, was the fifth son of René II., Duke of Lorraine. He served in Italy under Francis I., distinguishing himself at the battle of Marignano (1515). The title was bestowed upon him for his services in suppressing a revolt in Lorraine. He married Antoinette of Bourbon, and was the father of Mary of Guise, wife of James V. of Scotland and mother of Mary, Queen of Scots. His son, **FRANCOIS DE LORRAINE** (1519-63), second duke, was one of the greatest generals of his time. His chief military exploit was the successful defence of Metz against Charles V. (1553). He afterwards became the leader of the Catholic party and conducted the war against the Huguenots, whom he defeated at Dreux (1562) and elsewhere. He was assassinated. His memoirs are extant. **CHARLES, CARDINAL DE LORRAINE** (1525-74), brother of the preceding, was one of the most bitter opponents of the Huguenots. He was employed in a diplomatic capacity by Francis II. and Charles IX. **HENRI I. DE LORRAINE** (1550-88), third duke, son of François, distinguished himself while still a boy in the war against the Turks in Hungary. He afterwards carried on the struggle against the Huguenots, whom he encountered at Jarnac and Moncontour (1569). He was one of the chief promoters of the massacre of St. Bartholomew (1572), and founded the "Holy League," nominally in defence of Church and State, but really for the purpose of raising himself to the throne. Emboldened

by his successes against Henri of Navarre, he entered Paris on the "day of the barricades," in defiance of the prohibition of Henri III., who was forced to withdraw to Blois. Thither the duke was summoned and an outward reconciliation was effected, but he was immediately afterwards assassinated by the king's command, together with his brother and fellow-conspirator **LOUIS, CARDINAL DE LORRAINE** (1555-88). **HENRI II. DE LORRAINE** (1614-64), fifth duke, took part in the Neapolitan insurrection of 1647, but fell into the hands of the Spaniards (1648). In 1652 he was released, and returned to Paris. He subsequently became grand chamberlain.

Guise, a fortified town in the French department of Aisne, on the Oise, 25 miles E.N.E. of St. Quentin. The castle of the Dukes of Guise, now in ruins, is situated on a height above the town. Cotton and woollen goods are manufactured, and there are oil-works, tanneries, and iron-works established by M. Godin and conducted on the co-operative principle.

Guitar, a musical instrument resembling the lute, with six strings, three of which are of catgut and the remainder of silk interwoven with silver wire. It is played by striking the strings with the fingers of the right hand, the left hand being employed to make the notes of the music on the finger-board.

Guisot, François Pierre Guillaume (1787-1874), statesman and historian, was born at Nîmes of a Huguenot family. After his father's execution (1794) he was brought up at Geneva by his mother. In 1805 he went to study law at Paris, but devoted himself chiefly to literature, and in 1812 was chosen professor of modern history at the Sorbonne. Under the Restoration Government of 1814 he was Secretary-General of the Ministry of the Interior, whence he removed to the Ministry of Justice after the Hundred Days. In 1821 he was driven from office owing to his opposition to the reactionary policy of the Bourbons. During his exclusion from a life of public activity, which lasted until 1828, he put himself forward as the representative of the *Doctrinaires*, a political school whose ideal was the English constitution, and pursued his historical studies, publishing the *Mémoires* relating to English and French history, the first part of the *History of the English Revolution*, and the lectures on the *History of Civilisation*.

After the Revolution of July, 1830, he was at first Minister of the Interior, and subsequently, as Minister of Public Instruction (1832-1836), organised a system of primary education. In 1840 he resided in England for a short time as ambassador, but was recalled by Louis Philippe to take the post of Foreign Minister in a cabinet which was virtually placed under his direction. In 1847 he became Prime Minister in name as well as in fact. His foreign policy was at first very successful. The friendly relations with England, which had been threatened by the warlike policy of Thiers, were maintained until Palmerston's return to office as Foreign Secretary in 1846; but his conduct in regard to the "Spanish Marriage" brought the French Government into discredit, and compelled

Guizot to rely on the support of Austria and other reactionary courts. At the same time he adopted a reactionary policy at home, governing by means of oppression and corruption, and refusing to concede parliamentary reform. He was finally driven from power by the Revolution of 1848, and devoted the remainder of his life to literary and historical studies. After a period of exile in London, he returned to France, and settled at Val Richer, near Lisieux. Guizot was a man of considerable ability and force of character, but he was too narrow-minded to be able to cope with the political difficulties of the time. As an historian he did much to develop critical and scientific methods. Among his chief historical works, besides those already mentioned, were his *History of Representative Government*, and his *Life, Correspondence, and Writings of Washington*.

Gujarāti (GUJRĀTī), one of the chief Gaurian (Neo-Sanskritic) languages, current throughout Gujarat, West India. It flows directly from the Sauraseni Prakrit, and retains a large number of the old Sanskrit inflections, and has also borrowed numerous Arabic and Persian elements. Gujarāti, which is written with a modified form of the Devanāgari characters, is the language of the Parsees of Bombay. It has undergone little change since the fifteenth century, when its forms were fixed by Narsingh Mehta, the first noted Gujarāti author.

Gujars, a widespread nomad Aryanised people of Northern India scattered over the North-Western Provinces and parts of Kashmir. Tall, gaunt figures, forehead and lower part of the face narrow, nose curved, light eyes, scant beard. Those of the Budil district, Kashmir, seem to have a peculiar idiom of Non-Aryan type, but all the rest speak the languages of their more permanent winter homes. "Thus there are Gujars in Kashmir who speak Kashmiri, while those who came to the middle mountains speak a mixed dialect of Panjabī, or Dogri and Pahari" (F. Drew, *Jammu and Kashmir*, p. 110). The Gujars are probably of Jāt stock; those of Peshawar, who are Mohammedans, form "khels" or tribal groups like their neighbouring Afghāns.

Gujerāt, a province of N.W. India, consisting chiefly of the Baroda dominion and the native states on the peninsula of Kathiawar. It includes the districts of Ahmedabad, Kariah, Broach, and Surat, which form part of the Bombay Presidency.

Gujramvala, a district and town in the Punjab, 40 miles north of Lahore. It was the birth-place of Runjeet Singh.

Gules is the heraldic name for the colour red when employed in armoury. The derivation of the word is obscure, several possible origins having been suggested. When engraved, perpendicular lines at right angles to the top of the escutcheon are used to represent it.

Gulf Stream. The Gulf Stream is so-called from the Gulf of Mexico, whence it flows in a north-easterly direction, skirting the coast of North America. It has at first a minimum breadth of 50

miles, and a maximum speed of 5 miles an hour. As it advances its speed lessens, and it gradually becomes broader. The depth varies inversely with the breadth; between Bermuda and New York the former is 100 fathoms, the latter 80 miles.

On arriving at Newfoundland it diverts its course, and crosses the Atlantic in two divisions. The more southerly of these proceeds eastwards to the coast of Morocco; the other passes Great Britain and Norway on its way to the Arctic Ocean, where its influence has been observed some distance beyond Spitzbergen. The limits of the stream, especially in the earlier part of its course, are discerned by the deeper blue of its waters, as well as by the masses of fog which hang about its borders. It carries along with it vast quantities of seaweed, torn away from the coral reefs in Florida Strait and the Bahama Sea. On passing within it the navigator enters a region with a different climate and supporting different forms of animal life from those of the surrounding ocean. Its temperature on leaving the Gulf of Mexico reaches 84° in summer, and when it reaches Europe its waters are from 10° to 12° warmer than those of the Atlantic. The mild climate of Western Europe, as compared with other regions in the same latitude, must in large measure be ascribed to its influence, as well as to the general prevalence of south-westerly winds.

The origin and characteristics of the Gulf Stream may be understood from the general theory of ocean-currents. The surface water of the North Atlantic sinks below the ocean-level owing to the weight arising from its low temperature, its place being taken by a warmer in draught from the south. This general tendency from north to south and south to north is, however, modified by the rotation of the earth, the different action of different winds, and the varying formation of the coast-line. The rotation of the earth makes itself felt in the following manner:—The swiftness with which an object moves eastwards varies inversely with its distance from the equator, so that the water below the surface which the in draught from the south meets in its northern movement has a continually diminishing rate of progress from west to east. But the surface-water has a tendency to retain its original speed, the result being that it strikes off in a north-easterly direction. The lower waters from the north are exposed to an opposite set of conditions, and are therefore driven towards the south-west. This double action, together with the influence of the coast-line, explains the circular course which currents often take.

The preceding account partly explains the characteristics of the Gulf Stream, but, when traced to its origin, it belongs to a different, though not altogether distinct, class of currents—those, namely, which arise through the action of winds. It is one of the two branches into which the equatorial current, produced by the trade winds, and advancing westwards from the west coast of Africa, divides after reaching the east coast of Brazil. Proceeding in a north-westerly direction through the Caribbean Sea it enters the Gulf of Mexico, and after being confined there is driven forth with greatly increased velocity through the Bahama

Sea and the Strait of Florida. It is maintained that the force of this impulse is lost long before the shores of Europe are reached, but as the waters which arrive here are certainly those which emerge from the Gulf, the name still remains applicable. There is a corresponding equatorial current with several branches in the Pacific Ocean.

Gulf-weed, or **SARGASSO-WEED** (*Sargassum hacciferum*), a sea-weed belonging to the order Fucacee, with berry-like air-bladders, but rarely fructifying. An enormous mass of detached pieces of this weed floats in the Atlantic about lat. 20° to 25° N. and long. 40° W., covering over 200,000 square miles, where it was discovered by Columbus.

Gull, any bird of the sub-family *Larinae*, typical of the *Laridae*, a family of sea-birds, in which the nostrils are lateral and naked, the three front toes completely webbed, and the hind toe, if present, small and set above the line of the others. There are two sub-families, *Rhynchosinae* and *Sterninae*. [SKIMMER, TERN.] The type genus *Larus*, with six hundred species, is universally distributed. The bill is of moderate length, with cutting edges and decurved towards the point, the wings long, and the tail square at the end. They are greedy, rapacious birds, feeding chiefly on fish and small marine animals, though the great Black-backed Gull preys upon wild fowl, and many species eat the eggs of other birds. They generally nest near the sea, often in large companies, though some breed far inland, and the commoner species may often be seen at some distance from the sea picking up larvae and worms from newly-ploughed ground. Their power of flight is very great. The general plumage of adults of both sexes is white, with a mantle varying from bluish-grey to slaty-black, and at different times of the year there may be patches of dark feathers on the head and neck. In young birds the plumage is brownish, mottled with black and white. The peculiar cry of the gull has given it its popular name in most Teutonic languages, and this name survives in the term sea-mew. The flesh of young birds and the eggs are often eaten. The largest British species is the Great Black-backed Gull (*L. marinus*), about twenty-eight inches in length. It often occurs in large flocks, but seldom breeds in this country. The Lesser Black-backed Gull (*L. fuscus*), some five inches less, breeds in the north of England, Scotland, and on the coasts of the British Channel. The Herring or Silvery Gull (*L. argentatus*), about two feet long, is common all round our coasts. The Common Gull (*L. canus*) is only a winter visitant, but breeds in Scotland. The Black-headed or Laughing Gull (*L. ridibunda*) is abundant in the eastern counties and in Scotland. Occasional winter visitants are the Iceland Gull (*L. leucopterus*) and the Glaucous Gull (*L. glauces*), and still rarer is Ross's Gull (*Rhodostethia rosea*), an Arctic form, with rosy-tinted plumage and a dark ring on the neck. The genus *Xema* contains the Fork-tailed Gulls, and *Rissa* the Kittiwakes, in which the hind toe is absent. *R. tridactyla*, about fifteen inches long, is widely distributed, and is one of the species whose wings

are largely used for plumes for ladies' hats. The Skuas (named from their cry, "Skui, skui") constitute the genus *Stercorarius*. They are sometimes called Parasitic or Robber Gulls from the fact that they rob other sea-birds of their prey. *S. cataractes*, about two feet long, with brown plumage, generally breeds between lat. 60° and 70° N., but is an occasional visitor to the north of England.

Gumboil, alveolar abscess, inflammation affecting the tissues of the gum which overlie the alveolar processes of the jawbones, usually arises in connection with disease of a tooth. An abscess may be formed, which either bursts or may be brought to an end by evacuation of the matter which it contains. Superficial alveolar abscess, the gumboil proper, seldom calls for surgical interference, but in the case of a deep alveolar abscess, situated at the root of the fang of a tooth, the proper treatment consists in extraction of the tooth.

Gums and Gum-resins. Gums, properly so-called, are exudations from plants, soluble in water, at least in part, forming with it a mucilage insoluble in alcohol of 60 per cent., convertible by sulphuric acid into dextrin (q.v.), and with nitric acid yielding mucic and oxalic acids. They are quite amorphous, being neither organised like starch, nor crystallisable like sugar. Many of the so-called gums of commerce are, however, resins or gum-resins, these terms, like "balsam," being often very loosely employed. There is, in fact, an insensible gradation from the limpid essential oils (q.v.) to the solid resins. Attar of roses (q.v.), for instance, is an essential oil solid at ordinary temperatures, and other essential oils commonly contain varying proportions of solid substances known as *stearyptenes*, such as the camphors, dissolved in their liquid portion or *eleoypene*. When the resin is so incompletely dissolved in the essential oil as to form a viscous body, it is termed an *oleo-resin*; whilst it is proposed to restrict the term "*balsam*" to those fragrant substances (mostly oleo-resins) which contain cinnamic or benzoic acid in addition to the volatile oil and resin. True *resins* are insoluble in water, but mostly soluble in alcohol, essential oils, ether, or heated fatty oils, non-crystalline, incapable of sublimation, burning with a bright but smoky flame, and containing little oxygen and no nitrogen. A typical resin is a pale yellow, transparent solid, with a glass-like fracture and little or no smell or taste. The term *gum-resin* is a correct designation for various inspissated plant-saps, which contain both gum and resin. These definitions exclude those derivatives of the milky latex of most plants, the caoutchoucs or *rubbers* (q.v.), which are insoluble in water, alcohol, or un-concentrated acid, and are essentially mixtures of hydro-carbons containing oxidised substances or resins.

The chief classes of true gums are (i) gum arabic, (ii) gum tragacanth, (iii) cherry gum, (iv) Bassora gum, and (v) mucilage. Gum arabic is typically entirely soluble in water, and is said to be a potassium and calcium salt of gummic or arabic acid. The best, *Gum Senegal*, is the product of *Acacia Senegal* (= *A. Verek*); other kinds

are *Suakin gum*, from *A. stenocarpa* and *A. seyal*; *Mogador gum*, from *A. gummifera*; *Babul gum*, from *A. arabica*; the *Wattle gums*, from various Australian species; and *Gum Mexquite*, from Mexican species of the allied genus *Prosopis*. Gum tragacanth, formerly called gum dragon, is only partly soluble in water. It is obtained from *Astragalus gummifer* and other species in Asia Minor. Closely similar is *Gum Kuteera* obtained from the Bixaceous *Cochlospermum Gossypium* in India and from species of *Sterculia* in tropical Africa. Cherry-tree gum, from species of *Prunus* and *Amygdalus*, is not used commercially; but *Caramania* or *Bassora Gum*, also known as *Hog Tragacanth*, which is used to adulterate true Tragacanth, is said to be of similar origin. Among the chief mucilages are those of linseed, quince-kernels, and marsh-mallow roots. They consist largely of the insoluble constituent of gums which is known as *bassorin* ($C_{12}H_{20}O_{10}$).

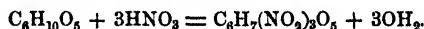
The chief gum-resins, including the fragrant *myrrh*, and *frankincense*; the fetid *ammoniacum*, *asafetida*, *galbanum*, and *opoponax*; the medicinal *gamboge*, *guaiacum*, *copaiba* and *euphorbium*; and the extractive *scammony*, and *jalap*, are separately described.

Gumti, a river of India, which flows into the Ganges near Benares. Lucknow and Jaunpoor are situated on its banks.

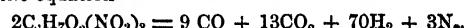
Gum-trees. [EUCALYPTUS.]

Gun-cotton. The history of gun-cotton may be said to commence in 1832, when it was observed by Braconnot that strong nitric acid acts upon woody fibre, starch, etc., with the production of a very combustible material, which was then called *Xyloidine*. Little practical result ensued, however, from this discovery till 1845, when Schonbein, by treating cotton with a mixture of nitric and sulphuric acids, obtained a new explosive substance. The manufacture of this "gun-cotton," as it was now called, was taken up in Germany, and rapidly spread into other European countries; but neglect of attention to details in its manufacture led to the gun-cotton obtained being insufficiently safe and to a number of accidents, so that it fell again out of common usage. Sir Frederick Abel, however, made so many great improvements in the production of this compound that it was again brought to the front and established as a most safe and useful explosive. The manufacture as carried out at Waltham Abbey in the Governmental factory is briefly as follows:—The best cotton waste is employed, freed from fatty oils, and is carefully selected, teased out, cut into lengths, and dried. The dried cotton is then added in small portions to a mixture of the strongest sulphuric and nitric acids in cast-iron pans, being left in the liquids for five minutes, when it is taken out and pressed. It is then allowed to stand for a day in pots kept cool by running water. The gun-cotton is afterwards dried by a "centrifugal" machine, revolving at a very high velocity, after which it is thoroughly washed with water and dried again as before, and boiled by steam. It is next converted into

"pulp" by a machine, "the beater," and is then transferred into large tanks, in which it is well washed in water. The gun-cotton is now tested, and, if satisfactory, is collected, and the water squeezed out. It is then compressed by great hydraulic pressure (five tons to square inch) into slabs, etc. The composition of gun-cotton thus prepared may be taken as that of *tri-nitro-cellulose*, $C_6H_7(NO_2)_3O_5$, although the quantity of NO_2 is always slightly lower than this. The equation of its formation would be then:



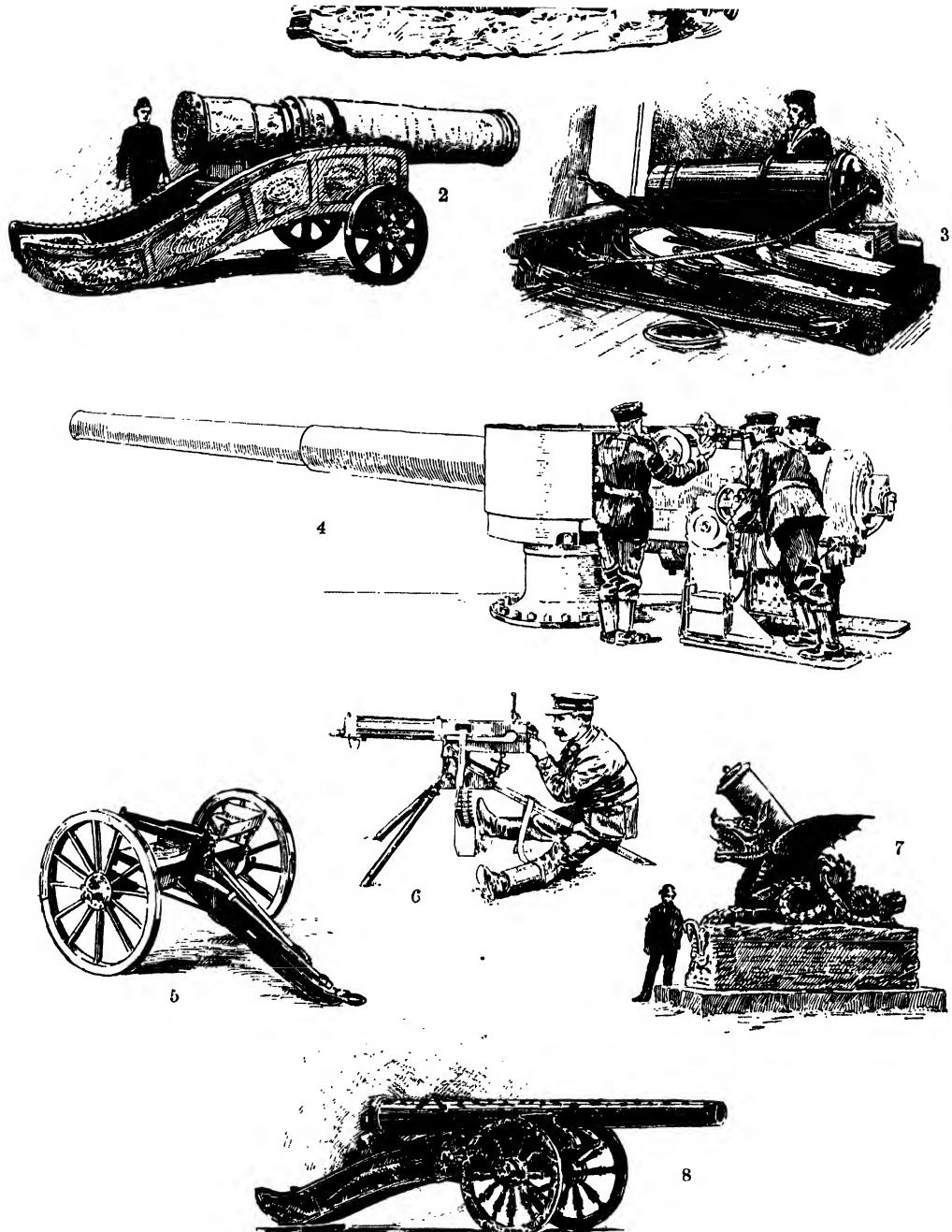
It is a solid with a specific gravity of about 1·6, is insoluble in water, alcohol, and ether. Its chemical department shows it to be a nitric ether—i.e. to have the composition $C_6H_7O_2(O-NO_2)_3$. In the open it burns with a fierce yellow flame. It may be exploded by percussion, but, if struck, only the part directly affected explodes, the surrounding material being unaltered. It may, however, be detonated if dry by the explosion of a small quantity of fulminate of mercury in contact with it, and this is the means commonly adopted to effect its explosion, the slabs, etc., having small holes drilled in them while moist to receive the fulminate. Moist gun-cotton is not readily detonated by this means, but this can be readily done by the detonation in contact with it, of the dry material. This renders the substance a very safe explosive for use, as the greater bulk can be carried moist, a smaller quantity being carried dry for "primers," which are themselves detonated by the fulminate of mercury. The decomposition which takes place when gun-cotton is exploded may be represented by the equation



It is seen that the quantity of oxygen present is not sufficient to completely oxidise the whole of the carbon—a part being only converted to the lower oxide. On this account many proposals have been made to mix with the gun-cotton a material containing excess of oxygen, as nitroglycerine, nitrates, etc., and explosives are so prepared, e.g. blasting gelatine.

The temperature resulting from the explosion of gun-cotton has been estimated as over double that in the case of gunpowder—i.e. at least 4,500° F. Its power is about three and a half times that of gunpowder, but is not as great as that of dynamite. It is very largely employed for military and naval purposes, as for submarine mines, torpedoes, etc. Many preparations consisting essentially of gun-cotton are also frequently used. *Tonite* consists of a mixture of gun-cotton with about the same weight of barium nitrate $Ba(NO_3)_2$. It is used for rock-blasting. *Schultze's Powder* consists also chiefly of trinitrocellulose, but wood fibres are employed instead of cotton for its production, and is steeped in a solution of nitre before the final drying, while charcoal may also be added. It is chiefly employed as a sporting or blasting powder.

Gun Metal, an alloy consisting of copper and tin. For smaller cannon its composition is about copper 90·5, tin 9·5; for larger guns the quantity of



GUNS.

1. Hoop Iron Gun (from wreck of *Mary Rose*—temp. Henry VIII.).
2. Mons Meg.
3. Carronade of 1800 (from H.M.S. *Victory*).
4. 6-inch Quick-firing Gun.
5. Mountain Gun.
6. Vickers Light Automatic Gun.
7. Mortar (French) presented by Spanish Government to Prince Regent, 1812.
8. Gun captured in Egypt, 1801.

tin is slightly increased. It possesses in a high degree the qualities necessary for the purposes to which it is applied—viz. hardness, great tenacity, and the capability of being cast without difficulty. It is usually prepared by fusing copper, tin, and bronze with old gun metal, the two former being first fused together and added to the fused bronze and old metal. The alloy formed is kept melted for about half-an-hour and then cast in the moulds employed.

Gunnel. [BLENNY, BUTTER-FISH.]

Gunner, in the Royal Navy, a warrant officer whose duty it is to take charge of a ship's guns and ordnance stores. He receives, according to his seniority or temporary position, from 5s. 6d. to 8s. 3d. a day, and he may be promoted to the rank of chief gunner, with pay at 9s. a day. A gunner's mate is a petty officer appointed to assist a gunner.

Gunnery, the science of the construction and usage of guns, and especially of the loading, elevation, sighting, and firing of these weapons; of their ballistics, trajectories, velocities, energies, and penetrations; of ammunition and explosives, and, to some extent, of the chemistry of gases. It may now also be said to include the science of the construction of armour, of the properties of iron and steel, and of the resistance offered by earth, air, water, wood, masonry, etc. It will be readily seen, therefore, that the subject is too wide a one to be dealt with adequately here, and that reference concerning it should be made to special works. Of these the best are those which have been officially prepared for the British Government and printed for H.M. Stationery Office. They include the *Text Book of Gunnery*, the special handbooks for each of the various service guns, the *Gunnery Tables*, etc. For obsolete gunnery the student may consult *The Practical Seaman's Companion* (1747), and Thomson's translation of D'Antoni's treatises on gunpowder, firearms, and artillery (1789).

Gunpowder, an explosive, or violently combustible, composition of saltpetre, sulphur, and charcoal. Its invention is commonly attributed to the fourteenth century, but may be more properly ascribed to the eighth, if not, indeed, to an earlier period. Marcus Græcus gives a recipe for making it by mixing one part of sulphur with two parts of charcoal and six of saltpetre. The proportion of the different ingredients varies, however, as will be seen on reference to the following comparative statement of four samples of old military powder:—

	English.	French.	Italian.	Russian.	German.
Saltpetre	75·0	75·0	76·0	70·0	74·8
Sulphur	10·0	9·5	12·0	11·5	11·8
Charcoal	15·0	15·6	12·0	18·5	18·4

The ingredients are ground separately, mixed, moistened with water or urine, and incorporated by grinding. The mass is then pressed into cakes, broken up into grains, and dried by steam heat. The grains are sorted by sifting, and sometimes polished by agitation with a little plumbago. The finer the grain, the more rapid the combustion.

The explosive quality of gunpowder is due to the fact that, when fired, the charcoal and sulphur burn at the expense of the oxygen in the saltpetre, with the evolution of great heat and much smoke and gas. The gases are chiefly carbonic acid, carbon monoxide, and nitrogen. The smoke consists of such solid products as sulphide of potassium, carbonite and sulphate of potassium, and unburnt sulphur. Part of this smoke remains as "fouling" in the interior of the gun, and has to be continually removed by sponging. On an average, 100 parts by weight of powder exploded in a closed space give 43 parts of permanent gases and 57 parts of solids. The temperature reaching about 4,000°, the gases occupy a volume roughly equal to 2,500 times that of the original powder. The pressure generated by powder exploded in a closed space which it completely fills is about 42 tons per square inch. The general term "gunpowder" now includes a great many compositions which do not take the form of powders. For large guns, for instance, the mixture of saltpetre, sulphur, and charcoal is made into "rifle large grain," for larger guns into "pebble" (rough cubes of about $\frac{1}{8}$ in. each way), and, for still larger ones, into "prism" (pierced hexagonal cylinders 1 inch long by $1\frac{1}{2}$ inches in maximum breadth, weighing $1\frac{1}{2}$ oz. apiece). Moreover, many of the so-called modern powders are not only not powders but are not composed of the old ingredients. Among these are some of the smokeless powders, Cordite (q.v.), which has superseded "pebble" and "prism" powder for large guns.

Gunpowder Plot, a plot formed by a party of Roman Catholics early in James I.'s reign to blow up the King, Lords, and Commons with gunpowder. The conspirators were Robert Catesby, who had taken part in Essex's conspiracy, John Wright, and Thomas Winter. Guy Fawkes, a soldier in the Spanish army, was sent for from Flanders. Other members were Thomas Percy, John Grant, Winter's brother Robert, and Catesby's servant Bates. Three rich Catholics, Sir Everard Digby, Ambrose Rookwood, and Francis Tresham, were later admitted to the confederacy. The attempt was to be made on November 5, 1605, the day on which Parliament would meet. Tresham sent a letter to Lord Monteagle, warning him of the danger, which was shown to Robert Cecil. The Lord Chamberlain found a pretext for visiting the cellar with Monteagle on the afternoon of the 4th. There Fawkes was found. He was seized about midnight as he was returning to his post. The remaining conspirators fled, but within a few days Catesby and others had been killed, and the rest were tried and executed.

Guns, the big rifled weapons mounted on carriages for use in the army or in casemates or barbettes on the ships of a navy. In the British navy guns built on the "wirewound" system are used, the latest being the 13·5 inch which gives excellent results. The modern naval policy is to arm "capital" ships with large guns of tremendous power and range to the exclusion of smaller weapons.

Gunter, EDWARD (1580-1626), mathematician, was educated at Oxford, and became professor of

astronomy at Gresham College in 1619. He invented the sector, with the lines called Gunter's scale, and the surveying chain, and was the first to observe the variation of the compass.

Guntur, a town in the Madras Presidency, 47 miles W.N.W. of Masulipatam.

Gurgaon, a district in the Delhi division of the Punjab, with an area of 1,940 square miles.

Gurians, a historical people of West Caucasus, whose territory lies on the Black Sea coast south of the river Rion. They are members of the Georgian family [GEORGIANS], and closely resemble the Georgians proper in usages, speech, and traditions. But there are two physical types, that of the uplands, distinguished by blue eyes and light hair, and that of the lowlands, marked by black eyes and black hair. The Gurians, originally subjects of the princes of Imeritia, acquired their independence in the fifteenth century, but were soon afterwards reduced by the Turks who were succeeded by the Russians in 1810 (Teule, *Pensées*, etc., vol. ii.).

Gurjun Oil, WOOD OIL, GURJUN BALSAM, or EAST INDIAN BALSAM CAPIVI, is a thin liquid balsam obtained from incisions in the stems of *Dipterocarpus alatus*, *D. turbinatus*, and other species in the East Indies. Its essential oil has the composition of that of copaiba (q.v.), viz. C_4H_{32} . It is imported from Moulmein, and is used in India as pitch or varnish for boats, and medicinally either as a substitute for copaiba, or externally for ulcers, ringworm, and leprosy.

Gurnard, any fish of the genus *Trigla*, of the acanthopterygian family *Cottidae*, with about forty species from tropical and temperate seas. The upper surface and sides of the angular head are bony, and the body is covered with small scales. In front of the pectoral fins are three finger-like appendages which serve as organs of touch and of locomotion, and by their means these fish crawl on the bottom, where they feed. When taken out of the water they make a grunting noise, caused by the escape of air from the swim-bladder, whence *T. lyra* is locally called the Piper, and other species are known on the Continent as Sea-cocks. Seven are British; the commonest are the Grey (*T. gurnardus*) and the Red Gurnard (*T. pinii*), both valued for food. Others are Bloch's (*T. cuculus*), the Streaked (*T. lineata*), and the Long-finned Gurnard (*T. obscura*), the Piper (*T. lyra*), and the rare Sapphirine Gurnard (*T. hirundo*).

Gustavus I., King of Sweden (1496-1560), known also as GUSTAVUS ERICSEN, and after his accession as GUSTAVUS VASA, was the son of Eric, Duke of Gripsholm. In 1517 he was treacherously seized, together with other nobles, by Christian II. of Denmark, who had then reduced the greater part of Sweden. After a year's imprisonment in the Castle of Kaloe, in Jutland, he was induced by tidings of Christian's forthcoming Swedish expedition to break his parole, and made his escape to Lübeck. With the help of the Lübecker he made his way to Calmar in May, 1520, but, meeting with

little encouragement in this part of Sweden, he withdrew into the wilder region of Dalecarlia. Here he lived for several years as a farm labourer, and gained so much influence over the neighbouring peasantry that they consented to follow him as their leader in a struggle with the Danes. His army gradually grew in strength, Upsala and other important fortresses fell into his hands, and he finally laid siege to Stockholm. In this crisis the states of the kingdom were convened, Christian was compelled to abdicate, and Gustavus was chosen king in his place (1523). His coronation took place two years later, and the crown was subsequently declared hereditary in his family. During the reign of Gustavus Sweden was raised from the low condition into which it had sunk to a state of high material prosperity. At the same time Lutheranism took the place of Catholicism as the established religion of his land, and education received a new impulse under the king's protection and care.

Gustavus II., or GUSTAVUS ADOLPHUS (1594-1632), became King of Sweden in 1611, on the death of his father, Charles IX., the son of Gustavus Vasa. He had received the best education which the times could give, and early gave proof of the restless energy, the stern force of character, and the firm adhesion to the Lutheran faith which distinguished his character in after life. At the time of his accession the country was overrun by Danish troops, but after a struggle of two years he secured a peace by which Sweden retained Gottenborg, Calmar, and Oeland. He next turned his attention to an enterprise which occupied him for the rest of his life—the establishment of Swedish sovereignty in the Baltic Sea. With this object he engaged in a war with Russia, and in 1617 he could boast that Russian vessels had been driven from the Baltic coasts. He next became involved in a war with his nephew Sigismund of Poland, the legal heir to the Swedish throne, who had been excluded on account of his adhesion to the Roman Catholic religion. This contest brought him into connection with Germany, for the Emperor Ferdinand was Sigismund's brother-in-law, and would be likely to render him aid. In 1620 Gustavus espoused the sister of George William, Elector of Brandenburg. The extension of Swedish power, the support of the German princes in their efforts to maintain their independence, and the furtherance of German Protestantism gradually formed themselves in his mind as parts of one great scheme. In 1628 he sent relief to Stralsund during its siege by Wallenstein. A treaty with Poland in 1629, which placed Elbing, Braunsberg, and Memel in his hands, left him free to take a more active part in German affairs. In 1630 he landed in Pomerania, leaving Sweden under the government of his chancellor Oxenstierna. The aged Boguslav, Duke of Pomerania, was persuaded to promise him support and to make him his heir, and by the treaty of Bärwalde (January, 1631) a large French subsidy was secured for a period of five years; but the princes of North Germany were loath to enter on a course

which would openly sever their connection with the empire. Fear alone induced the Elector of Brandenburg to admit his troops into Spandau, and John George, Elector of Saxony, joined him too late for him to avert the fall of Magdeburg. On September 17 Tilly, the Imperial general, was defeated by a joint army of Swedes and Saxons at Breitenfeld near Leipzig. After rejecting the overtures of Wallenstein, Gustavus determined on marching to the Rhine provinces, as a centre of Protestant influence, where he might form the *Corpus Evangelicorum*, which was to take the place of the Empire. After establishing his power in the Palatinate and wintering at Mentz, he advanced in the following spring through Franconia into Bavaria. Tilly was defeated and mortally wounded at the passage of the Lech, and Gustavus entered Munich in triumph; but in the meantime Wallenstein had been recalled, and, after failing to storm his entrenchments at Nuremberg (September, 1632), Gustavus was forced to follow him into Saxony. He was overtaken and defeated at Lützen, but Gustavus himself, cut off by his rash impetuosity from the main body of his troops, lost his life in the battle. The fame of Gustavus is based on his career as the champion of European Protestantism, but he also introduced many domestic reforms which endeared him to his own countrymen.

Gustavus III., King of Sweden (1746–1792), succeeded his father Frederick Adolphus in 1771. In the second year of his reign he forced the Diet to accept a new constitution, after raising an armed force on the pretext of putting an end to the general disorder. The senators, who had previously been arrested, resigned their usurped powers into the hands of the king. Gustavus, on the whole, showed himself an enlightened ruler, although his extravagant tastes pressed somewhat heavily on the national finances. A war with Russia which broke out in 1788 led to no important results. Gustavus was preparing to join the league against the French republican government when he was assassinated in the opera-house by Captain Ankarstroem, an agent of the discontented nobility.

Gustavus IV., King of Sweden (1778–1837), succeeded his father, Gustavus III., in 1792. Having made himself very unpopular by rashly engaging in a war with Russia which resulted in the loss of Finland, he was in 1809 deposed by his nobles in favour of his uncle Charles, Duke of Sudermania. After wandering under assumed names through several European countries, he at last settled at St. Gall, in Switzerland, where he died.

Gutenberg, JOHANN (c. 1410–1468), was born of a good family at Mainz, and went from there to Strasburg. He was a man of much versatility, and devoted his energies to many objects, at one time having a scheme for polishing precious stones, at another the making of looking-glasses; but the invention which brought him renown, though little else, was the use of movable type in printing. In 1446 he was back in Mainz, where a John Fust or Faust aided him more than once with funds for

carrying on his printing. In 1445 and the following years he printed a folio Latin Bible, but his work was not profitable, and eventually he died in poverty, without children, and almost without friends.

Guthrie, THOMAS, D.D. (1803–1873), a Scottish preacher and philanthropist, was born at Brechin, and went to school there, afterwards proceeding to the university of Edinburgh, where he studied for ten years. In 1826 he went to Paris, where he studied anatomy, and in 1830 he was ordained and married. He did much for his parishioners, starting a savings-bank, a Sunday-school, and a library. In 1837 he was called to Edinburgh, where he made a great mark as a preacher. In the great split of the Church he threw in his lot with the Free Church. He did good work for his poor, being greatly instrumental in bringing about the Scottish Education Act, establishing ragged schools, and he was an earnest though not bigoted advocate for total abstinence from strong liquors. He retired in 1864. Besides publishing many works, he long edited the *Sunday Magazine*, and was a frequent contributor to *Good Words*.

Guttapercha, the commercial name for the hardened milky sap of various plants belonging to the order Sapotaceæ, native to the Malay peninsula and archipelago. The trees from which it is obtained range from lat. 6° or 10° N., to 10° S., and from long. 100° to 120° E. Being more easily so used, they have been felled in great numbers since 1842, when Dr. William Montgomerie first introduced this substance into England. Each tree yields only 12 or 13 pounds of gutta, and between 1854 and 1875 over three million trees are said to have been felled in Sarawak alone. Our imports, which rose from 4½ million lbs. in 1857 to 10 million lbs. in 1870, have since declined, now averaging about 7 million lbs., whilst, as there is a steady demand for the substance for casing submarine cables, the price has risen considerably. "Gutta" is the Malay term for gum, and "percha," the name of the island of Sumatra, the tree itself being known as "taban;" but the species from the latex in the bark of which the gutta was originally obtained, *Palagium Gutta*, is said to no longer exist in a wild state. The best quality comes from *P. oblongifolium*, "taban marah," that mostly exported from "taban simpor," *Payena Maingayi*. The crude gum is generally exported in oblong balls of a greyish-white colour, with a slightly reddish tinge inside, weighing from 13 to 26 lbs. each. It is almost as hard as wood; but at 120° F. it becomes dough-like, and at 145° or 150° F. can be readily rolled or moulded. In Tradescant's Museum (1656) it is thus described as a curiosity:—"The plyable mazer-wood, being warmed, will work to any form." Chemically, guttapercha is a mixture of two resins, one *albin* ($C_{20}H_{32}O_2$), white and crystalline, and forming 6 to 14 per cent., the other, *fluaril* ($C_{20}H_{32}O$), yellow and amorphous and forming an equal proportion, in from 75 to 82 per cent. of a milk-white fusible hydro-carbon, containing about 88 per cent. carbon and 12 per cent.

hydrogen, known as pure *gutta*. It is used for moulds for electrotypes, in all forms of electric insulators, for boot-soles, for speaking-tubes, ear-trumpets, stethoscopes, etc. The chief substitutes as yet tested are *Paucharcea*, from *Bassia (Dichopis) elliptica* of the west coast of India, and *Balata*, from *Mimusops Balato* of Guiana and the West Indies, both of which are products of members of the same natural order.

Guttiferae, an order of thalamiflora dicotyledons (q.v.) comprising some thirty genera of woody plants, natives of moist situations in the tropics, characterised by their resinous juice. They have opposite, leathery entire leaves, numerous stamens, often coherent, a flesh disk, a stigma usually sessile and radiate, and exalbuminous seeds. They are generally acrid, and their resin is yellow. Among the chief genera are *Garoinia*, to which belong the mangosteen (q.v.), the kola nut (q.v.), and the gamboge (q.v.), and *Calophyllum*, which includes Poon, and other valuable East Indian timbers.

Gutzkow, KARL (1811–1878), German novelist and dramatist, was born at Berlin. He studied at the university there, and in 1831 undertook the publication of a periodical which turned out a failure. In 1832 he published *Briefe eines Narren an eine Nürrin*. For a time he contributed to a periodical at Stuttgart, and in 1835 went to Frankfurt and started the *Deutsche Revue*—his next work, *Wally die Zweiflerin*, forming the starting-point of what was called “the Young Germany” movement. He was for a time imprisoned for his writings. He then married, and soon after composed a tragedy called *Ricard Savage*. Other of his works were *Zopf und Schwert*, *Das Urbild des Tartuffe*, *Uriel Acosta*. In 1842 he wrote *Briefe aus Paris*, in 1850 *Die Ritter vom Geiste*, and in 1859 *Der Zauberer von Rom*. His later works fell off in power and quality.

Gützlaff, KARL FRIEDRICH AUGUST (1803–1851), Chinese missionary, was born at Pyritz in Pomerania. His desire was for missionary work, but his parents, who were poor, could not afford the training, and Karl was apprenticed at Stettin. The King of Prussia enabled him to carry out his wishes, and in 1826 he went to Batavia, where he learnt Chinese. He afterwards visited Siam and translated the Bible, and at last he went to Macao and to Hong Kong, where he translated the Bible into Chinese. One of his chief works was to train native missionaries who could carry their doctrines to regions to which Europeans were not admitted.

Guy, THOMAS (1645–1724), the founder of the hospital which bears his name, was born in Southwark. After his father's death he went with his mother to Tamworth, and was later apprenticed to a London bookseller, becoming in due course a freeman of the Stationers' Company, and, in 1668, a bookseller on his own account. For a time he printed for the University at Oxford, which was in collision with the royal printers about the question of printing Bibles. In 1695 he entered Parliament as member for Tamworth. Later he paid a fine rather than serve as sheriff, from, it was said,

motives of economy. He was penurious in personal habits, but generous and charitable to others. He built a town hall and an almshouse in Tamworth gave money to poor relations and insolvent debtors and relieved poor families. In 1704 St. Thomas's Hospital was greatly benefited by him. He had made a fortune by timely selling-out of South-Sea Stock, and this enabled him to carry out his design of erecting what was at first intended to be supplementary to St. Thomas's Hospital, but afterwards developed into a separate institution. Besides building and endowing this hospital, he left money to many other charitable purposes.

Guy of Warwick, a character of mediæval fiction, possibly having an origin in some traditional character whose adventures are variously related. One account makes him a son of Siward of Wallingford, who, being put to proof of his valour by his lady love, fought the Saracens, came to Athelstan at York and killed a dragon, then married, then returned to the Holy Land as a palmer, and coming back to England killed the Danish champion Colbrand who with Anlaf was besieging Athelstan at Winchester. There appears to be some possible ground for this last legend if for Anlaf we read Olaf. He then is said to have lived at Warwick as a hermit, only revealing himself to his wife by sending her a ring from his deathbed. Another account makes the real Guy of Warwick to have been a Guy Beauchamp who died in 1315. Countless ballads and romances have set forth the incidents of his adventure with a furious dun cow. Its rib is still to be seen at Warwick, together with Guy's porridge-pot, and portions of his armour.

Guyon, JEANNE MARIE BOUVIÈRES DE LA MOTHE (1648–1717), a French mystic and quietist, was born at Montargis of an aristocratic family. She was brought up when quite young by Ursulines and Benedictines, and practised many austerities. She was very anxious to take the veil, a course which her family would not allow. In 1663 she went to Paris and into society, and married M. Guyon. The marriage was not happy, and she took refuge in the indulgence of mystic fancies. In 1676 her widowhood left her more free, and in 1681 she gave herself to active religious works. In 1683 she published *Les Torrens*, and in 1684 a *Treatise on Prayer*. In 1688 she was imprisoned for heresy, but the influence of Madame de Maintenon obtained her release, and she went to live with her daughter, now married, near Paris. Fénelon and Bossuet had conferences, and Fénelon fell into disgrace for siding with her. She was afterwards banished to Blois. One of her characteristic writings was a mystical interpretation of the Song of Songs.

Guyon, RICHARD DEBAUFRE (1813–56), a soldier of fortune, was born at Walcot, near Bath. His father, a commander in the English navy, was of Huguenot descent. In 1831 the son entered the Austrian service, and, marrying the daughter of a Hungarian baron, lived for a time a retired country life. He did good service in the revolutionary

cause, and, upon the failure of the movement, went to Turkey, where he became a Mussulman and entered the Sultan's service as Kourshid Pasha. He took part in the Crimean War, and aided in organising the army of Kars.

Guy's Hospital, founded and endowed by Thomas Guy, was opened in 1725. It was further endowed by a Mr. Hunt in 1829. The income, which amounts to about £40,000 annually, is mainly derived from land in Essex, Lincoln, and Hereford. There is now accommodation for about 700 patients. The number of in-patients is about 5,000, that of out-patients about 70,000 annually. An important medical school is attached to the hospital.

Guzman-Blanco, ANTONIO, was born at Caracas in 1830. From 1863-68 he was Vice-President of Venezuela, and being driven from power he re-established himself in 1870, and though not always nominally President was the real arbiter of the country. In 1889 he was deposed while absent in Europe. He died in 1899.

Gwalior, a native Indian state under the control of the English Government. It consists of scattered districts, the principal of which is separated from Agra and Etawah by the Chambal. The extreme range of the state is between lat. $23^{\circ} 21'$, and $26^{\circ} 52'$ N., and long. $76^{\circ} 31'$ and $79^{\circ} 21'$ E., and it contains about 30,000 square miles. The N.E. part is level and not particularly productive, but farther S. it rises into scattered hills, on one of which is situated the fortress of Gwalior. In the middle is a plateau with an average height of 1,500 feet, and bounded on the S. by the Mandu range of mountains. The chief rivers are the Nerbudda, Chambal, and Sind. The climate is good during the hot and dry seasons, and there is abundance of wild beasts and birds, and the waters are well stocked with carp and other fish. The chief productions are opium, wheat, maize, rice, oil-seeds, ginger, sugar-cane, indigo, tobacco, and cotton, and some iron is smelted. The principal exports are opium, cotton, tobacco, dyes, and iron. The population is varied, but the ruling race is the Mahratta. The town of Gwalior is interesting as a rock fortress, the sandstone hill having been artificially rendered stronger, as being an ancient seat of Jain worship, and as possessing a palace of fifteenth-century architecture.

Gwennawi, the language of the negroes of Morocco. Most of the slaves in this region speak the Arabic dialect of their masters; but they also carefully preserve and hand down from generation to generation the Soudanese idiom, which they call *Lugha el Gwennavia*, "Language of the Blacks," which appears to be a Mandingo or Bambarra dialect.

Gwyniad, the Welsh name of *Coregonus clupeoides*, a food fish, known in the Lake district as the Schelly, and round Loch Lomond as the Powan and Freshwater Herring. When full grown it is about a foot long, with shining silvery scales. It feeds on *entomostraca*, insect larvæ, and beetles. [COREGONUS.]

Gyges, King of Lydia, dethroned Candaules and founded a new dynasty in 687 B.C. It would appear that with Carian and other mercenaries he overcame the opposition of the natives, and was confirmed in his position by the reply of the Delphic oracle. Inscriptions show him to have been a tributary to the King of Assyria, who aided him against his foes, the Cimmerians.

Gymnastics. The term "gymnastics" was applied by the Greeks to all bodily exercises, and included running and jumping, boxing, wrestling, throwing the javelin, etc. It is derived from *gymnos* ("naked"), because the performers were either nearly or completely naked. These exercises formed an important part of education in ancient Greece, and became common at Rome during the period of the Empire. During the Middle Ages youths of high rank were trained in exercises requiring physical strength and suppleness, but with the progress of the art of war they fell into disuse. The term "gymnastics" is now confined to exercises the direct aim of which is to develop the muscles and bones, especially those of the upper part of the body. The modern science of gymnastics originated in Germany as a result of the greater importance attached to physical vigour as a means of promoting the general health. Gymnastic exercises were first introduced by Johann Basedow in his school at Dessau in 1774. In 1811 a gymnasium was established at Berlin by Friedrich Ludwig Jahn, and henceforward the practice of gymnastics became general in Prussia among all classes. From Prussia it passed to Sweden, where it became an essential part of military training, and produced so marked a change in the efficiency of the Swedish troops that in 1844 the same methods were adopted by Louis Philippe in the French army. The movement spread from France to the other Continental countries. In England private gymnasias were established at Oxford (1858) and elsewhere, and at a somewhat later date gymnasias for the use of soldiers were erected at Aldershot and other military stations.

Gymnastic exercises either consist simply of movements of the limbs—a branch of the science which has received much attention in Sweden, especially at the hands of Professor Ling (1776-1839)—or artificial aids of various kinds may be used. These may be either movable, as in the case of dumb-bells and bar-bells (bars about 3 feet in length with weights at both ends), or immovable. The most important immovable appliances are the horizontal bar, which may be heightened or lowered to the required level, and the parallel bars, two bars about $2\frac{1}{2}$ ft. one from the other, and about 4 ft. above the ground. The other appliances include iron rings suspended by ropes from the roof, the trapeze-bar which also hangs from the roof, horizontal and vertical ladders, and ropes and poles for climbing. Loose flannel clothing is always worn by gymnasts.

Gymnoblastic Hydroids, an order of the *Hydromedusæ*, a sub-class of the *Hydrozoa* (q.v.). The polyps form branching colonies, which are invested with a delicate chitinous cuticle, which

does not, however, form cup-like expansions into which the hydranths can be withdrawn. Examples of the group are *Tubularia*, *Cordylaphora*, *Hydractinia*. When free-swimming medusæ are formed they possess eyes, and bear the sexual products round the manubrium; they are known as Anthomedusæ (q.v.).

Gymnolemata, the sub-class of Bryozoa belonging to the group Ectoprocta (q.v.), including the three most important orders, the Cyclostomata (q.v.), Ctenostomata (q.v.), and Cheilostomata (q.v.). The main character of the sub-class is that the arms around the mouth are arranged in a circle instead of a horse-shoe, as is the Phylactolaemata. With the exception of the one genus *Paludicella*, they are all marine.

Gymnosomata, the order of Pteropoda (q.v.) or Sea-butterflies, in which there is no shell in the adult.

Gymnosperms, the lower of the two divisions of flowering plants or spermophytes (q.v.), comprising a single class, the *Gymnospermia*, the living representatives of which, some 400 species referred to about 40 genera, are grouped in three natural orders, the *Cycadæ*, *Coniferae* (including *Taxineæ*) and *Gnetaceæ*. Though including plants differing widely in mode of growth, these three orders have many characters in common, and exhibit intermediate conditions between the Pteridophytes and Angiosperms. On the one hand, they approach the Lycopodiæ, especially *Isoetes* and *Selaginella*, in some respects, and the Equisetinae in others, so that we can only derive them from some common ancestor of the pteridophytes, whilst on the other hand they approach dicotyledons rather than monocotyledons. They are all woody plants with exogenous stems, which seldom branch in the cycads, but do so freely in conifers. They increase in diameter by a ring of cambium, but the medullary rays are invisible, being often only one cell broad, and tracheids, or elongated cells with bordered pits, take the place of vessels in the secondary wood, i.e. in the rings of wood formed by the cambium. An apical meristem of numerous small cells replaces the large apical cell of most of the higher cryptogamia. The leaves are generally simple with one vein, and do not all produce axillary buds. The flowers are always unisexual, seldom have even the rudiment of a perianth, and have generally an elongated axis, which with its sporophylls is known as a *cone*. The pollen-sacs or microsporangia are produced separately on the under surface of the staminal leaves or male sporophylls, and the pollen grains show their affinity to the microspores of lower groups by undergoing division into two or more cells, one or more of which (the *included cells*) form a rudimentary male prothallium, whilst the pollen-tube is given off by another. Carpels are sometimes absent, as in the yew, and when present do not form an ovary, style, or stigma, whence the ovules are naked, from which character the group derives its name. The ovules may be terminal or (in *Ginkgo*) lateral axial structures, or may be marginal

lobes of an open carpellary leaf, as in *Cycas*, or may be in the axes of the carpels, as in cypress and juniper, or on peculiar placental structures, as in the *Abietineæ*. The embryo sac or microspore is at some distance below the apex of the tercine, has a thickened wall or *exospore*, and is filled before fertilisation with an *archisperm*, on the upper surface of which several *archegonia*, formerly known as "corpuscula," are formed. There being no stigma or style, the pollen-grain, carried by wind, falls directly into the micropyle; but its pollen-tube, after penetrating a little way into the tercine, commonly pauses for a considerable time, often for months, before growing on to the top of the embryo sac. Several embryos are frequently developed from one seed, either from the fertilisation of the oosphere or central cell of more than one archegonium, or from a division of the *suspensor* (q.v.) which results from the fertilisation of one, each division bearing an embryo (*polyembryony*). Coniferous wood occurs fossil in Carboniferous rocks, and to the same period belong the *Cordaitæ*, a group possibly intermediate between cycads and conifers. But we may expect further light on the affinities of the now isolated groups of the Gymnospermia from future paleontological discoveries. [CYCADS, CONIFERÆ, WELWITSCHIA.]

Gymnotus, a genus of eel-like fishes, with one species (*G. electricus*), the electric eel, about six feet long, from the rivers of Brazil and Guiana. There are no scales, or caudal or dorsal fins, and the anal reaches to the end of the tail. It is the most powerful electric fish known.

Gynandrophore, an elongation of the floral axis within the flower below the stamens, so that both androecium and gynoecium are carried upon a stalk. This structure is but rarely developed and gives the name *Gynandropis* to a genus, allied to the capers, in which it does occur.

Gynandrous, having the androecium and gynoecium, i.e. the stamens and carpels, adherent into a column or *gynostemium* in the centre of the flower, as in orchids and Asclepiadaceæ. Such plants were placed by Linnæus in a class *Gynandria*.

Gynobasic, springing from the base of the ovary, a term applied to the style of united carpels when, owing to the greater development of their ovarian portions towards the outside or periphery, the style rises from the centre of a depression within the ring of carpels. It occurs markedly between the four divisions which result from the two carpels in the Labiatæ and Boragineæ. [REGMA.]

Gynophore, an elongation of the floral axis below the ovary, i.e. between the stamens and the ovary. We have such a structure in the passion-flowers, in the genus *Alohemilla*, and notably in the capers (*Capparis*), besides other instances.

Gynostemium. [GYNANDROUS.]

Gypsies, the English name of a nomad people of undoubtedly Indian origin, who, about A.D. 1000,

began to move in probably several waves of migration from the Indus valley westwards through Afghānistān, Persia, Asia Minor, and Syria to Europe, where they first made their appearance in the 14th century. The course of their wanderings can be followed through these regions, where they are still represented by the Luri, Kauli (*i.e.* Kābuli), and Karāchi (*i.e.* "Blacks") of Persia; the Xebeques of Anatolia; the Kurpadh of North Syria; the Nowars of South Syria, and the Chin-giané of Turkey and the Levant. This last, identified by some with the Chinganes of the Lower Indus, is the most general European name, occurring in many countries under diverse modified forms; all, however, referable to the *Sekane*, which their chief, calling himself "Duke of Little Egypt," declared to be the name of his followers when summoned before the authorities of the Hanseatic Towns in 1417. Hence the German Zigeuner, the Italian Zingari, the Spanish Zincale, and perhaps also the Ἀτρογχανοί or Αθληγάνοι (Acingani) of the Byzantine writers, though these are heard of before the assumed date of the first migrations from India. The other European names are due to popular views regarding the origin or practices of these nomads. Such are the Scandinavian Tatars, the Dutch Heidenen ("Heathens"), the French Bohemians, those who first reached Paris in August, 1427, having probably come overland from Bohemia; lastly the Spanish Gitanos, and the English Gypsies (Gipsies), that is Egyptians, as if the first arrivals in Spain and the British Isles had been *via* the Mediterranean from Egypt.

But the proper tribal name always has been *Rom* (man, husband), which has been traced to the wandering low-caste *Doms* (*d* and *r* interchangeable) of North India. [DOMS.] It is noteworthy that the feminine forms of these words (*Romni, Domni*) correspond, and are Sanskrritic, as in *rāja, rāni*; but all the Gypsies cannot be Doms, for many—perhaps the majority—seem to have been Jāts of Sindh, whence their alternative name *Sinti*, that is, people from the Sindhu (Indus) river. The Luri Gypsies of Persia appear to be certainly Jāts, and it was about the time of the overthrow of the Indus Jāts by Mahmūd of the Ghaznevi dynasty (1025) that probably took place the first great dispersion westwards. The two events, conquest and dispersion, seem related as cause and effect. It is also to be noticed that the Romni (Romanī) language, though degraded and affected by elements from the speech current in all the lands traversed by them, is distinctly a Gaurian or Neo-Sanskritic dialect intermediate between the Panjabī and the Sindhi. All are derived independently from the Prakrits, or vulgar Sanskrit idioms, which formed the connecting link between classical Sanskrit and the Neo-Sanskritic tongues as first represented in literature by the poet Chand. The Romni grammatical forms show that the dispersion took place while these tongues were still in process of formation, which would again point to the early part of the 11th century.

The Gypsies were first heard of in Greece (Crete) in 1322, and they soon after reached Wallachia, whence the second, or what may be called the

European, dispersion took place. This also was connected with a Mohammedan conquest, for it followed immediately after the invasion of Wallachia by the Turks in 1415; hence their first appearance (see above) in Germany in 1417, in France 1427, and about the same time in England. That they reached England by this overland route, and not from Egypt, as was popularly supposed, seems evident from the fact that in the English Roumi dialect there are Greek, Magyar (Hungarian), Slav, German, and French elements, but no Arabic or Coptic, which must have been picked up had they passed through the Nile delta. In recent years they have crossed the Atlantic, and Gypsy encampments are already familiar sights in some of the eastern states of the American Union; for wherever they wander they tenaciously adhere to their old nomad habits, and also everywhere show the same tastes and follow the same pursuits of tinkers, horse-dealers, strolling minstrels, prowlers about farmyards, just like their Indian ancestry. Nevertheless there are exceptions, and the *Tiganes* of Bulgaria have become a sedentary hard-working peasantry, have adopted the Moslem religion, and almost forgotten their Roumi mother-tongue, now speaking either Turkish or Bulgarian even in their homes; but the type has remained quite pure, and can be instantly recognised amongst the surrounding populations. But there are two types (Jāt and Dom) which may be best studied in Roumania, where some are distinguished by crisp black hair, thick lips, and a very dark complexion, others by a fine profile, regular features, and a light olive complexion. Here also they are grouped in three social classes, like the Hindu castes: (1) *Laieti*, traders and minstrels; (2) *Vatrari*, servile, employed as domestics and retainers in the great houses; (3) *Netoți*, the so-called "Atheists," most savage and wild of all the Gypsy race. Such distinctions are not observed amongst the western Gypsies, because after the Wallachian dispersion the classes became mixed, and all, so to say, "broke caste." (C. Leland, *Proc. Philological Soc.*, March, 1879, and other writings; F. Kanitz, *Mittheilungen der Anthropol. Gesellschaft*, Vienna, 1877; J. W. Ozanne, *Three Years in Roumania*, 1878; Borrow; Miklosich.)

. **Gypsum**, hydrous sulphate of lime ($\text{CaSO}_4 + 2\text{H}_2\text{O}$), an abundant mineral formed by the evaporation of saline waters and often occurring in extensive beds associated with rock-salt, as in the New Red Sandstone of our north-west Midlands, in the Purbeck beds, and in the Paris Eocene. When in transparent, colourless, pearly crystals, often in arrow-shaped twins, belonging to the Oblique system, it is known as *selenite* (q.v.); when fibrous and silky, as *satin-spar*; and when massive and but slightly translucent, as *alabaster*. Its hardness being only 2, this latter form is commonly carved for ornaments and internal embellishments for buildings. Gypsum is a valuable manure, and is added to water to render it "permanently hard" for brewing purposes, a process known as "burtonising;" but its chief use is in the manufacture of plaster of Paris (q.v.). This substance is simply

gypsum deprived of its water by burning and ground fine. On the addition of water, chemical recombination, or "setting," takes place, accompanied with some expansion and the giving-off of heat.

Gyration. [ROTATION.]

Gyrfalcon. [FALCON.]

Gyrinidae, the family which includes the Whirligig beetles (q.v.).

Gyroscope is an instrument intended to illustrate the phenomena of rotating bodies, generally the study of the combinations of different rotations imparted to the same body. It consists essentially of a metal wheel with heavy rim, provided with a stiff and strong axle pivoted inside a circular frame of metal as light as strength conditions will permit. A strong spin may be given to the wheel without disturbing this outer framework, which may be held by the hand during the operation. The principle of the gyroscope has recently been adapted to locomotion, as is shown by the success of the so-called Mono-rail, invented by Louis Brennan, C.B. [ROTATION.]

H.

H, the eighth letter of the alphabet, is the Phoenician letter *cheth*, the value of which was the same as that of *ch* in the Scotch word *loch*. Both the Greek "rough-breathing" and the Latin H were derived from *cheth*. In Anglo-Saxon H was still a guttural, but it afterwards became a spirant. In English it has disappeared before many words beginning with a consonant, as *loaf*, *neck*, *ring*, and is (in South Britain) scarcely heard in the combination *wh*, which was originally *hw*, but to this rule the word *who* forms an exception. In French, Spanish, and Italian it has been entirely lost, although in the first two the character is retained. In German musical notation the letter H denotes B natural, the letter B being used for our B flat.

Haarlem, the capital of North Holland, and one of the finest towns in the Netherlands, is 12 miles west of Amsterdam, and stands on the river Spaarne about 4 miles from the sea. St. Bavo's Kerk, built in the 15th century, contains a renowned organ with 8,000 pipes. The Teyler Institution has, besides, a fine library and observatory, an excellent collection of physical instruments. In Haarlemmer Hout (wood) stands the royal palace of Welgeleque. There are also an academy of sciences, and royal schools for teachers and clinical surgery. The town, through which run several canals besides the river, is a centre of the trade in bulbs and seeds. Silk, velvet, carpets, and Haarlem *boutjes* (a mixture of linen and cotton) are manufactured. The history of Haarlem goes back to the 12th century. It forfeited its privileges by siding with the peasants in 1492, and in the religious struggle of the 16th century stood a siege of seven months by the Spaniards, who subsequently perpetrated horrible outrages on the survivors.

Haarlem Lake, which was drained by an English company employed by the Government between 1839 and 1852, was formerly a lagoon connected with the Zuyder Zee. In 1836, when its area was nearly 50,000 acres, the lake overflowed, and caused much damage in Amsterdam and Leyden. From the clayey soil at the bed of the lake, "klinkers" or paving-bricks used to be made.

Habab, a powerful pastoral people, of north-east Abyssinia between the Bogos (Bilen) and Beni-Amer south and north, and north-west of Massowa. Their territory, which is now included in the Italian colony of Eritrea, occupies the strip of coastland between lat. 16° and 17° 30' N. and the neighbouring plateau as far inland as the Falkat river separating them from the Beni-Amer; area 2,500 square miles, population 70,000 to 80,000. The Hababs appear to have been originally a southern branch of the Bejas [BEJA], whom they still resemble in their physical appearance and nomad usages; but having later been brought under Abyssinian influences, probably during the flourishing period of the Axumite empire, they now speak a Geez dialect [GEEZ] closely akin to that of the neighbouring kingdom of Tigré. They were also within recent times nominal Christians recognising the authority of the Abyssinian Abuna (Patriarch), but are now for the most part Mohammedans, like their Beni-Amer neighbours and kinsmen. Like all these north-eastern nomads, they have their winter and summer stations, camping from June to October on the Nakfa plateau (4,000 to 6,000 or 7,000 feet above the sea), and then descending with their numerous herds and flocks to the grazing-grounds of the Sahel ("coastlands"). Over their territory are scattered many curious monolithic monuments which have not yet been studied by archaeologists, and which they attribute to the Bet Maliyeh aborigines, many of whom still survive in the country. (W. Munziger, *Gebiete der Beni-Amer und Habab in Petermann*, 1872; Von Heuglin, *Le Territoire des Beni-Amer et des Habab* in *Bull. de la Soc. Khediviale de Géographie*, 1876.)

Habakkuk ("The Embracing"), one of the Jewish minor prophets, the date of whose work is placed by Delitzsch, on grounds of internal evidence, in the 12th year of Josiah, or 630 B.C. Other commentators consider him to have lived in the reign of Jehoiakim, son of Josiah, at a later period in the 7th century.

Habeas Corpus is a writ by which the personal liberty of the subject can be enforced. By the Petition of Right (3 Charles I.) it is expressly declared that no freeman shall be imprisoned or detained without cause shown, to which he may make answer according to law, and by the 16th Charles I. c. 10 it was enacted that if any person should be restrained of his liberty by order or decree of an illegal court, or by command of the King's Majesty in person, or by warrant of the Council Board or of any of the Privy Council, he should, upon demand of his counsel, have a writ of *habeas corpus* to bring his body before the Court of

King's Bench or Common Pleas, and such court should thereupon determine whether the cause of his commitment were just, and should forthwith do as to justice should appertain. And by Statute 31 Charles II., c. 2, commonly called the "Habeas Corpus Act," amended and made more effectual by the 56 George I., c. 100, the methods of obtaining the writ of habeas corpus are so plainly pointed out and enforced that, so long as this statute remains unimpeached, no subject of England can be long detained in prison, except in those cases in which either the general law requires and justifies such detention, or else some special legislation (always regrettable) has been found necessary so to provide in exceptional circumstances. Moreover, lest the habeas corpus should be evaded by demanding unreasonable bail or sureties for the prisoner's appearance, it is declared, by a statute passed in the first year of the reign of William and Mary, that excessive bail ought not to be required, though, on the other hand, to prevent such abuses as are usually apt to occur in the resort to a writ of this description, it is a rule with the courts that they will not grant a habeas corpus as of course or without probable cause shown.

Of great importance to the public is the preservation of this personal liberty. If even the highest magistrate could imprison arbitrarily whenever he or his officers thought proper, as in pre-Revolutionary France was the frequent practice of the Crown, there would soon be an end of all other rights and immunities. Indeed, some have thought that unjust attacks even upon life or property at the arbitrary will of the ruler are less dangerous to the commonwealth than such as are made upon the personal liberty of the subject. To deprive a man of life, or by violence to confiscate his estate, without accusation or trial, would be so gross and notorious an act of despotism as must at once convey the alarm of tyranny throughout the whole kingdom; but confinement of the person by secretly hurrying him to gaol, where his sufferings are unknown or forgotten, is a less public, a less striking, and therefore a more dangerous engine of arbitrary government. And yet sometimes, when the State is in real danger, even this may be a necessary measure, as has frequently happened in the administration of Ireland. But the happiness of our constitution is that it is not left to the executive power to determine when the danger of the State is so great as to render this measure expedient, for Parliament alone, when it sees proper, by suspending the Habeas Corpus Act for a short and limited time, can enable the Crown to imprison suspected persons summarily, and without the possibility of their obtaining their discharge during that period by resort to the courts, as the Senate of Rome was wont to have recourse to a dictator when they judged the Republic to be in grave and imminent danger.

Habeas corpus as a form is not known to the law of Scotland. The way in which a person imprisoned gets his trial brought on, or his release if he is not brought to trial, is there called "Running Letters."

Habington, WILLIAM (1605–1654), an English poet, the son of an antiquary (THOMAS, d. 1647), who left valuable manuscript collections concerning the history of Worcestershire, was born and died at Hindlip in that county. His chief work was a collection of poems entitled *Castara*, written in praise of his wife Lucy, a daughter of William Herbert, Lord Powys. A play by Habington, *The Quene of Arragon*, is in Dodsley's collection, and he wrote also *The History of Edward the Fourth* (begun by his father), and *Observations upon Historie*.

Hackländer, FRIEDRICH WILHELM (1816–1877), the Dickens of Germany, was born near Aachen. He was in early life engaged in trade, but also saw some service in the Prussian army. The latter experience he turned to account in his *Tales of Soldier-life in Time of Peace* (1841), and its sequel. In 1841 he went with Baron von Tübenheim to the East, and two years later accompanied the Crown Prince of Würtemberg on a European tour. In 1847, after serving with Radetzky in the Sardinian war, he wrote *Soldier-life in Time of War*. Soon after this he married and settled at Stuttgart. He wrote several comedies (*Der Geckige Agent*, etc.), but made his reputation chiefly by his *Humorous Tales*, and his novels *Handel und Wandel* (*Up and Downs*, translated by Mary Howitt), *The New Don Quixote*, *The Dark Hour*, *Day and Night*, and *Zig-zag Stories*. He was for five years director of the royal buildings and gardens, and was ennobled in 1861 by the Emperor of Austria.

Hackney, a large parish and borough in Middlesex, to the N.E. of the City of London, containing Clapton, Dalston, Homerton, Shacklewell, Stamford Hill, and Stoke Newington, now forms part of the "County of London." The parish has an area of 3,297 acres, and the borough, which returns three members to Parliament, is 3,937 acres in extent. [LONDON.] Pop. (1901), 270,335.

Haddington, the capital of Haddingtonshire, Scotland, is nearly in the centre of the county on the river Tyne, 17 miles E. of Edinburgh. It has one of the chief grain-markets in Scotland, and its abbey-church, called "The Lamp of Lothian" (*Lucerna Laudonie*), is of great antiquity. This royal burgh, which was several times burnt in the wars with England, was the birthplace of John Knox, and of Jane Welsh, wife of Carlyle.

Haddingtonshire, or EAST LOTHIAN, a maritime county in the south-east of Scotland, having Midlothian as its western and Berwickshire as its southern boundaries. It has a coast-line of more than 30 miles from Musselburgh on the Firth of Forth to the border of Berwickshire on the North Sea. The area of the county is 280 square miles. Large crops of wheat, beans, and "Dunbar reds" (potatoes) are obtained. There are fisheries at Dunbar and in the coast-villages. The chief towns are Haddington, Dunbar, North Berwick, and Musselburgh. The county sends one member to Parliament.

Haddock, the surname of a distinguished naval family. SIR RICHARD (d. 1715) fought at the battle of Solebay, in 1672, and was wounded. He was knighted in 1675, made commander-in-chief in the Medway in 1682, and in 1689 appointed Controller of the Navy, a post which he held until 1714. NICHOLAS (1686-1746) took part in the victory off Cape Passaro. He attained flag-rank in 1734, and in 1738 was made commander-in-chief in the Mediterranean.

Haddock (*Gadus aeglefinus*), a common but very important British food-fish of the Cod family, ranging round the coasts of Europe, without entering the Baltic or Mediterranean, and across the Atlantic to the eastern coasts of North America. In shape the haddock resembles the cod (q.v.), but is of much smaller size, from two to four pounds being the general weight, though much larger specimens are on record. In higher latitudes fish three feet long have been met with, but those taken around our own shores are about a foot in length. The general colour is greyish-white above, and the white belly is mottled with grey. The lateral line is black, and the dark spot above the pectoral fin has led to the identification in folklore of this fish with that from which St. Peter took the tribute-money. Haddocks are taken with trawl-nets and long lines. The best smoked haddocks (*Finnon haddies*) come from the fishing village of Finnon or Findon six miles south of Aberdeen.

Haddon Hall, a fine old mansion, belonging to the Duke of Rutland, is on rising ground near the Wye, 23 miles N.N.W. of Derby. It has previously belonged to two other noble families, and is mentioned in *Peveril of the Peak*. An illustrated account of it is to be seen in two works by Cattermole.

Hade. [FAULT.]

Haden, SIR FRANCIS SEYMOUR (b. 1818), a talented etcher and writer on etching, was born in London and educated at University College and the Sorbonne, Paris. He practised for some years as a surgeon at the West End, and became F.R.C.S. in 1857. His first important etchings were produced about 1858. He became President of the Society of Etchers in 1889, and died in 1910.

Hadendoa, HADENDOWA, a large branch of the Beja Hamites [BEJA], whose territory extends from the foothills of North Abyssinia northwards to the Suakin district on the Red Sea coast. The tribal subdivisions are very numerous, some pastoral, others agricultural, with two permanent stations: Fillik on the plain east of the Herdub affluent of the Gash, and Miktinab farther south-west on the opposite side of the Herdub. Under the Egyptian rule, before the Mahdi's revolt, Miktinab was the official capital and residence of a hereditary prince whose authority was recognised from Tokar below Suakin southwards to Kassala and throughout Taka, three-fourths of whose inhabitants are Hadendoas. In Munziger's time (1870) they were said to number as many as a million; but they were greatly reduced during the Mahdist troubles (1884-92).

when they were in frequent collision with the British forces holding Suakin. They are a fierce, warlike people who still speak the Beja (Hamitic) language, though many of the chiefs understand Arabic and claim Arab descent.

Hades, in Greek mythology, was the name of the nether world, the abode of the dead, and also that of the god who ruled there, Pluto, the brother of Zeus.

Hadley, JOHN (1682-1744), inventor of the reflecting quadrant, was from an early age a proficient in mechanics, and took out a patent for a water-wheel. In 1717 he became a fellow of the Royal Society, and was afterwards Vice-President. In 1719 he made the first serviceable reflecting telescope, and in 1730 the idea of his great invention seems to have occurred to him at the same time as it did to Newton. Hadley was intimate with Sir Hans Sloane, near whom he had a house in Bloomsbury. His brother GEORGE (1685-1760) was the first to formulate the now accepted theory of the trade-winds.

Hadley's Quadrant, or the REFLECTING QUADRANT, was introduced by John Hadley in 1731 to take the place of the backstaff, or Davis's quadrant. It was formerly used for taking the altitudes of the sun and stars, and for taking angles in surveying. Its form was that of an octagonal sector of a circle. The arc, therefore, contained 45°, but, there being double reflection, the limb was divided into 90°. The quadrant is now superseded by the sextant.

Hadramaut, the name given to a strip of coast in the south of Arabia, to the north-west of Aden; but the whole of the country to the south of the desert is often so-called on the maps. The chief town is Makulla. Coal and copper abound in this country.

Hadrian. PUBLIUS AELIUS HADRIANUS (76-138), fourteenth Emperor of Rome, was born in the imperial city. He was the son of a cousin of the Emperor Trajan, and was in great favour with Plotina, his wife. He had held several offices and was in command of the army in Palestine when he was summoned to receive the purple in 118. He spent the next sixteen years in visiting every part of his dominions. Having repelled the attacks of the barbarians beyond the Danube and put down a conspiracy at Rome, he crossed over to Britain and provided for its protection from the Caledonian tribes by fortifications and stations. After passing through Gaul and Spain he hurried to Parthia and intimidated Chosroes into submission. He paid several lengthy visits to Athens, and also stayed some time at Alexandria and Antioch. He discouraged persecution of the Christians; but he put down a revolt of the Jews with great severity, and in 133 Jerusalem was occupied as a Roman colony, and named Aelia Capitolina. Hadrian's last four years were spent at Rome, where he built a mausoleum for himself, the ruins of which remain, and restored the baths of Agrippa, the Temple of Augustus, and other buildings. He selected as his successor Ceionius Commodus Verus, and when the latter died adopted T. Aurelius Antoninus (q.v.).

Hadrian was one of the greatest of the emperors. He showed generally a forbearing temper, but the sufferings of his later years may have irritated him into some of those acts of cruelty of which he has been accused. Hadrian's address to his departing spirit has in itself made his name famous.

Hadrian's Wall, a stone wall, with a ditch on the north and a *ravum*, or line of ramparts, on the south, extends from what is now Bowness, on the Solway Firth, to the mouth of the Tyne. Considerable remains are still to be seen, the wall in some places being nine feet in height. Two accounts of it have been written by Dr. Collingwood Bruce.

Haeckel, ERNEST HEINRICH (b. 1834), the great German biologist, was born at Potsdam and educated at Würzburg, Berlin, and Vienna. He settled at Jena in 1861, and became professor of zoology there in 1865. In the following year he met Darwin in London. He has travelled for the purpose of zoological research from Norway to Ceylon, and has also visited Madeira and the Canary Islands. His monograph on the Red Sea corals (1876) was the result of an exploration undertaken in 1873. The chief of his other monographs are *The Radiolariae* (1862) with which is given an elaborate atlas, that on calcareous sponges (*Kalkschwämme*, 1872), and the work on jelly-fishes (*System der Medusen*, 1879); while he also made contributions to the *Challenger* reports. Among his more general works are *Générale Morphologie*, *The Natural History of Creation*, and *Anthropogenie*. Haeckel was the first German who accepted the Darwinian theories, and he has done more than anyone to popularise them. For a detailed exposition of his views see EMBRYOLOGY, HEREDITY, etc.

Hæmatemesis (from two Greek words signifying vomiting of blood). This term, as its etymology signifies, is applied to the act of bringing up blood from the cavity of the stomach. It is by no means so simple a matter as might at first sight appear to distinguish the source of blood brought up through the mouth, and hæmoptysis (q.v.) and hæmatemesis are not infrequently confused the one with the other. Blood brought up from the stomach has not usually the bright red colour possessed by that which comes from the lungs, nor is it so intimately mixed with the expectorated mucus. If blood remains in the stomach for a sufficient length of time to enable the digestive juices to act freely upon it, it acquires the appearance of coffee grounds. Hæmatemesis may be due to gastric ulcer, or to cancer of the stomach. It is also common in association with the congested state of the gastric mucous membrane which exists in *cirrhosis* of the liver.

Hæmatin, a coloured material formed by the decomposition by acids or alkalies of the *haemoglobin* (q.v.) of the blood. It is usually obtained as a scaly mass of a blue-black colour, which when powdered appears dark-brown. The generally but not universally accepted formula for the substance is $C_{34}H_{36}N_4FeO_5$. It is sometimes found in the faeces, and in certain poisoning cases in the urine.

It is usually identified by the spectroscopic examination of its solution.

Hæmatite, so named from the Greek *haima*, blood, from its red streak, is the mineral sesquioxide of iron (Fe_2O_3), containing, when pure, 70 per cent. of iron and 30 per cent. oxygen. When crystalline it belongs to the Rhombohedral system, occurring in rhombohedra and tabular crystals of an iron-black or steel-grey colour, sometimes with a splendid metallic lustre, when it is known as *specular iron-ore*, such specimens from Elba having been employed by the Romans as hand-mirrors (*specula*). Its hardness is 5·5 to 6·5, and its specific gravity 4·5 to 5·3. In very thin plates it appears red by transmitted light, and it has a cherry-red streak. In an earthy condition it is known as *red ochre* or *reddle*, and is used as a paint in crayons and in polishing glass. Hæmatite also occurs commonly in mammillated masses with a radiating internal structure, known as *kidney-iron-ore*. It is sometimes magnetic. Hæmatite is one of the chief iron-ores. It occurs, replacing calcite, in pockets and fissure-lodes, in the Carboniferous Limestone, in Furness, and to a less extent in Cumberland, South Wales, Devon, and Cornwall. It is imported from Spain. Pilot Knob, Missouri, is a hill 700 feet high, almost entirely hæmatite, and a large part of Gellivard in the north of Sweden is similarly made up of this ore. It occurs in lavas at Vesuvius and Ascension.

Hæmatocèle, a swelling produced by effusion of blood into one of the internal cavities of the body.

Hæmaturia, the occurrence of blood in the urine. This symptom may be due to disease (injury, inflammation, calculus, cancerous growth or parasites) affecting the kidney, ureter, bladder or urethra. It occurs also in consequence of the use of certain drugs, and a variety of hæmaturia, paroxysmal hæmaturia, deserves special mention. In this last-named disease, which is very uncommon, the attacks of hæmaturia occur at irregular intervals, and are accompanied by shivering fits.

Hæmatoxylin is the colouring material to which logwood owes its importance for dyeing purposes. When first discovered it was known as "hæmatin," but this name was changed owing to its application to another totally different substance. It is obtained by extracting logwood with ether, allowing the solvent to evaporate and recrystallising the product from its hot aqueous solution. It then forms colourless or slightly yellow crystals easily soluble in alcohol, ether, or hot water. It possesses a sweet taste, and its composition is represented by the formula $C_{16}H_{11}O_6$, but its constitution is not yet well determined. If oxidised, as by exposure to air, it yields a red-brown powder, *hæmatin*, of composition $C_{16}H_{10}O_8$. Hæmatoxylin, in the form of extract of logwood, is largely employed for dyeing blacks and blues upon fabrics. Iron or chromium mordants are usually employed, but the colours obtained are unfortunately comparatively fugitive if exposed to light. It is also used for staining microscopic objects and animal tissues.

Hæmin, a substance which can be manufactured from blood. Its importance is due to the fact that it forms characteristic crystals which can be readily recognised under the microscope. If a small portion of dried blood, or of material in which the presence of blood be suspected, be finely powdered with a little common salt, placed on a glass slide, treated with a few drops of glacial acetic acid, and then heated to dryness, microscopic examination will show a number of dark brown rhombic crystals; the formation of these hæmin crystals thus constitutes a very delicate test for the presence of blood.

Hæmoglobin, the constituent of the red corpuscles of the blood, to which their chief importance as oxygen carriers in the human economy is due. It occurs to a variable extent in *venous* blood, but in *arterial* blood it only exists loosely combined with oxygen as *oxy-hæmoglobin*. Its chemical composition has not as yet been definitely ascertained. It may be obtained in crystals which ordinarily appear of a dark red or purplish colour, but the hue varies with the direction of the light. [PLEOCHROISM.] With a number of gases, other than oxygen, hæmoglobin can also enter into combination—as e.g. with carbon monoxide, nitric oxide-forming compounds resembling oxyhaemoglobin. [BLOOD.]

Hæmophilia, or Hæmorrhagic Diathesis. The subjects of this disease display a tendency to lose large and even alarming quantities of blood on very small provocation. Thus a mere scratch may produce considerable haemorrhage, and even the smallest operations, such as the extraction of a tooth, cannot in persons who suffer from the malady be undertaken without considerable apprehension. Hæmophilia is eminently hereditary, and generally affects the males of a family while the females escape. Though the female portion of a "bleeder family" do not themselves suffer from the disease, they transmit it to their male offspring.

Hæmoptysis (from two Greek words meaning spitting blood). This symptom is to be distinguished from haematemesis (q.v.). In hæmoptysis the blood comes from the lungs or the air passages, not from the stomach, as is the case in haematemesis. Hæmoptysis may be due to inflammation, ulceration, or cancerous or tubercular disease affecting the larynx, trachea, bronchii, or substance of the lung itself. In rare instances an aortic aneurism may burst into the air passages. Lastly pulmonary apoplexy may be mentioned, in which disease effusion of blood occurs in the texture of the lung, and the extravasated material is partly coughed up and partly accumulates in the tissues. Hæmoptysis is oftentimes the first symptom of consumption, that is, of the deposit of tubercle in the lung.

Hæmorrhage. [BLEEDING.]

Hæmorrhoids. [PILES.]

Hafiz ("one learned in the *Hadîths*," or sayings of Mahomet) is the name generally given to Shems-ed-Din, the great lyrical poet of Persia.

Little or nothing is known of his life, but he is thought to have died about 1388 A.D. He was said to have received his inspiration from El Khizar, a mythical saint, who gave him a draught of the water of life. So sweet were the contents of his *Divân* that the author of the collection was called *Chagarlab* ("sugar-lip") by his contemporaries. He also obtained the name of *Lîshan-ed-Ghayd* ("voice of mystery") from the fact that his beautiful images were held to imply the mystic doctrines of Sûfi philosophy. An English translation of a selection from the *Odes* of Hâfiz was made in 1802 by Richardson from a Latin version; and Sir William Ouseley, Bicknell, S. R. Robinson, and others, have translated specimens. The whole *Dirân* has been rendered into German, but no complete English version has yet appeared.

Hag (*Myxine glutinosa*), the popular name for an aquatic chondrate animal, the type of a family (*Myxinidae*), to which the name is often extended, and which, with the Lampreys, makes up the order Cyclostomata or Round-mouths. The eel-shaped body is scaleless, the single nasal aperture is immediately above the mouth, which is furnished with four pairs of barbules; there is one tooth in the middle of the palate, and two rows of comb-like teeth on the tongue. Along each side of the body forming a bead-like chain are glands which pour forth the mucus from which these creatures derive their generic and specific names. In the genus *Myxine*, with three species, there is one external branchial aperture on each side of the abdomen, leading by six canals to as many gill sacs. In the only other genus (*Bdellostoma*) with two species there are at least six such apertures on each side, each communicating directly with a separate gill sac. The distribution of the family corresponds with that of the cod family, upon which the hags prey, penetrating into their bodies and feeding on their flesh, whence the common species is also called the Borer.

Hagen, a trading town in the Westphalian coal-district, 12 miles N.E. of Elberfeld-Barmen. Iron-founding and puddling, and the manufacture of iron and steel goods, cotton, cloth, and leather, are its chief industries.

Hagenau, a town in Elsass-Lothringen, situated in a forest and standing on the Moder, is 21 miles (by rail) E.N.E. of Strasburg. Hops and wine are the chief articles of trade, and porcelain-stoves are manufactured. The churches of St. George and St. Nicholas date from the 12th and 13th centuries respectively.

Hagenbach, KARL RUDOLF (1801-74), theologian, was born at Basel and studied at Bonn and Berlin. He was appointed professor of theology at Basel in 1824, and was author of *Kirchengeschichte bis Zum 19 Jahrhundert*, *Encyclopädie und Methodologie der theologischen Wissenschaften*, a book on the history of dogmas which was translated into English, several biographies of ecclesiastics and other works.

Haggard, HENRY RIDER (b. 1856), novelist, was born in Norfolk. He was in South Africa from

1875 to 1879, at first as secretary to Sir H. Bulwer in Natal, and then with Sir Theophilus Shepstone in the Transvaal. After his return to England he published *Cetewayo and his White Neighbours* and a series of novels, the first to attain popularity being *King Solomon's Mines* (1886). Mr. Haggard has taken a special interest in land questions, on which he has lectured and spoken in various parts of the country, as well as on the continent and in the U.S.A. He journeyed through England during 1901 and 1902 investigating the condition of agriculture and of the rural population, and wrote *The Poor and the Land* in 1905. Recent novels are *The Brethren* (1904), *Ayesha* (1905), *Benita* (1906), *The Ghost Kings* (1908), and *The Yellow God* (1909).

Haggis, a Scotch dish made of the heart, liver, lungs, and other internal parts of a sheep, which are minced with onions and suet, and after oatmeal, salt, and pepper have been added, are sewn up in the large stomach-bag of the sheep, and boiled for about three hours. .

Hagiolatry, a general term including ancestor and manes-worship. [SAINT.]

Hague, THE (S' GRAVENHAGE, "the Count's Hedge"), the capital of South Holland and seat of the Dutch government, is on a branch of the Leyden and Rotterdam canal, 15 miles N.N.W. of the latter town, and 33 miles S.W. of Amsterdam. Originally a hunting lodge of the Counts of Holland, it became in 1584 the meeting-place both of the States of Holland and the States-General, as well as the residence of the Stadholders. In the next two centuries it was also an important diplomatic centre. The city is beautiful in appearance, the canals, shaded by rows of linden-trees, having a picturesque effect. There is also a museum in which are many Chinese and Japanese curiosities; a royal library, containing 4,000 MSS.; a large collection of books and coins; and many churches, the chief of which is St. James's, a Gothic building of the 14th century. In the Meermanno-Westreenen museum is a collection of early printed books. To the north of the city in the *Bosch*, or Park, stands a royal palace, to which is attached the Orange Hall. The Hague is connected by tramways with Scheveningen, a fashionable watering-place on the North Sea. Cannon-founding, copper- and lead-smelting, printing, and carriage-making are among the chief industries. Several learned societies have their headquarters in the city, which is adorned by statues of Spinoza, Bernhard of Saxe-Weimar, and princes of the House of Orange. The International Arbitration Court holds its meetings here.

Hahnemann, CHRISTIAN FRIEDRICH SAMUEL (1755-1843), the originator of homoeopathic treatment, was born at Meissen. In 1789 he began to devote himself to chemical research. While living near Leipzig he experimented on himself with Peruvian bark, subsequently basing his medical system on the conclusions so derived. After six years of experiment he published in 1796 his essay on *A New Principle for Ascertaining the Curative Properties of Drugs*. He was prosecuted

by the State for illegal dispensing, but held his ground at Leipzig till 1821, when he was finally driven out by the apothecaries. He now resided for some years at Kôthen under the patronage of the duke, but in 1835 he settled at Paris after having married a Frenchwoman as his second wife. In spite of their author's persecution, his doctrines made great progress in public opinion, patients coming for treatment from all countries. Hahnemann was the author of a book on preventive measures entitled *The Friend of Health* (1792). His statue was erected at Leipzig in 1851, where also a book on his life and works by Albrecht was published in 1875.

Haida (HYDAH), the collective name of a group of North American Indians who occupy all the islands and parts of the mainland on the N.W. coast between the Thlinkits in the north, the Carriers (Athabascans) in the east, and the Nootkas of Vancouver in the south. Their chief divisions are the Kaigani, Howkan, Klemakoaan, and Kazan at the southern extremity of Prince of Wales Archipelago; the Skiddegeats, Cumshawas, Laskits, and Skringwais of Queen Charlotte Islands; the Climsians about Fort Simpson and on Chatham Sound; the Nass and the Skenas on the rivers so named from them, the Sebasses on Pitt Archipelago and the shores of Gardner Channel; lastly, the Millbank Sound natives, including the Hailtzas, Bella Bellas, Bella Coolas, and others, with a total population of less than 10,000, scattered over a territory 40,000 square miles in extent. The Haidas speak a stock language of the usual American type, to which Powell has given the name of *Skiddigatan*, from the chief tribe in Queen Charlotte Islands. Both in physical appearance and mental qualities they differ greatly from all other American aborigines. Although the hair is black and of the general horse-tail texture, the complexion is remarkably fair—even the full-blood natives, and especially the women, having their skins as white as ordinary Europeans, so that the blue veins "are seen meandering even in the minutest branches" (Captain Dixon). They also display great skill and an exuberant fancy in their wood and bone carvings, in the heraldic devices of the tall posts set up before the dwellings of the chiefs, and especially in the elaborate tattoo-markings decorating the bodies of both sexes. These markings exhibit the family "crests" or totems, while the carved columns strikingly resemble the figures represented on the monuments of the Mayas and other Central American peoples. (Poole, *Queen Charlotte Islands*; J. G. Swan, *Tattoo Marks of the Haida Indians in Annual Report of the Bureau of Ethnology for 1882-83*, Washington, 1886.)

Haidinger's Brushes, in physical Optics, are appearances that present themselves when plane-polarised light [POLARISATION] is received into the eye under certain conditions. Thus, if the eye be rapidly directed from one image to another of an object viewed through a rhomb of Iceland spar, which is a transparent crystal that gives two images of any small object viewed through it, a pale yellow patch will appear, bounded by curved

arcs on either side, and with a violet patch contained in each set of curves. The brushes seem to be due to the fact that the eye is itself capable of polarising light, especially in the neighbourhood of the yellow spot, the coloured appearances corresponding to those that are seen when plane-polarised light is viewed through an external polarising medium.

Haiduk, or **HAJDUK** (*Hungarian a drorer*), a Hungarian soldier, belonging to the irregular infantry, who in the 16th century carried on a border warfare against the Turks. Their adhesion to the Protestant cause was in 1605 rewarded by Stephen Bocskai, Prince of Transylvania, with the privileges of nobility, the right of self-government, and a district on the left bank of the Theiss, enlarged in 1876, and now the county of Haiduk.

Hail consists of globules of ice that fall like rain. It is more usual in spring and summer, and is observed to fall during the heat of the day. Hail rarely falls during the night. The size of the globules varies from that of a pea to that of an egg or small orange; exceptional cases have been noticed where the hailstones have weighed as much as 3 lbs. Drops of rain that are whirled upwards by an ascending current of air will form snow if lifted sufficiently high; if they are rapidly carried to a greater height they will be frozen into ice and so form hailstones. In a whirlwind they may be carried up and down alternately for several cycles before escaping the eddy and falling to the ground, and may in these separate ascents receive fresh additions of compact snow or ice. Examination of a large hailstone will generally show the different layers of which it is thus composed.

Hailes, SIR DAVID DALBYMPLE, LORD (1726-92), Scottish judge, descended from a family of lawyers, was born at Edinburgh and educated at Eton and Utrecht. He was admitted to the Scotch Bar in 1748, was raised to the bench as Lord Hailes in 1766, and ten years later became a judge of the criminal court. He is chiefly known to posterity by his antiquarian researches, his friendship with Dr. Johnson, and his controversy with Gibbon, against whom he appeared as the apologist of Christianity. His chief works were *The Annals of Scotland. Memorials and Letters relating to the History of Britain in the Reign of James I.*, and an edition of *The Works of the Ever-memorable Mr. John Hailes of Eaton*.

Haileybury College, 2 miles S.E. of Hertford, was from its foundation in 1809 till 1858 a training institution of the East India Company. Here Malthus and Sir James Mackintosh were once professors, and Lord Lawrence and Sir Bartle Frere cadets. In 1862 the existing public school was opened and endowed with scholarships. The number of boys is limited by the charter to 500.

Haimura (*Erythrinus macrodon*), a large fish of the family Characidae, from tropical America. It is the type of a group of the family distinguished by the absence of an adipose fin. Its dentition is formidable, and the natives, who esteem it for food, take it with a line and in traps.

Hainan, an island off the south coast of China forming part of the province of Kwang-tong, and being the southernmost portion of the empire. It is 185 miles long and 90 broad. Kiung-chow is the capital. Hoi-how, its port, has been open to foreign trade since 1876. Pigs, sugar, eggs, and various nuts are exported, and there are extensive fisheries. In the interior, which is mountainous, gold is found. Rice, cocoa-nuts, and sesame seeds are also among the products of the island, which is subject to frequent earthquakes. The Les or aborigines (about a third of the population) claim to be independent of the Chinese government.

Hainault, a province of Belgium, bounded on the north by Brabant and Flanders, on the east by Namur, and having France on the south and west. It is the northern part of the old countship of Hainaut, which passed successively to Bavaria, Burgundy, and the house of Austria. The present province, constituted in 1815, has an area of 1,437 square miles. The French department of the Nord once formed the southern part of Hainault, is watered by the Scheldt, the Sambre, the Dender and the Haine, and produces much wheat, flax, and beet. There are valuable coal-mines in the south, and iron, marble, and limestone are the chief of the other minerals. Large manufactures of linen, porcelain, lace, and hardware are also carried on in the towns, and the Hainault breed of horses and cattle is celebrated. The forest of Ardennes covers the greater part of the south of the province. The chief towns, Mons and Charleroi, are in the south-east.

Hair. A hair consists of an aggregation of much modified epithelial cells, and may be regarded as an outgrowth from the epidermis or outer protecting layer of the skin. Almost all parts of the skin are studded with cylindrical follicles or depressions, in each of which the root of a hair is planted. Such follicles are entirely absent from the palm of the hand and the sole of the foot, and as regards the rest of the body they vary much in number and degree of development. The appearances seen on making a longitudinal section through a well-grown hair are depicted in Fig. 1. Of the two parts of which a hair is made up, the root and the shaft, only the former is shown in the diagram. The shaft—that is, the free portion which projects beyond the skin—must be supposed to be cut away. Outside the hair-root itself several structures will be noticed. These, the various layers of the hair follicle, are described in detail in Fig. 2. Immediately external to the hair-root the diagram shows a series of layers of epithelial cells, which make up the inner and outer root-sheaths. External to these is what is called the glassy membrane, and finally outside this lies the fibrous coat of the hair sac. To return to the longitudinal section, it will be seen that the root of the hair terminates in a bulbous enlargement, the *hair bulb*, and projecting into the substance of the bulb from below is a mass of fibrous tissue containing numerous cells and blood-vessels known as the *hair papilla*. The *hair bulb* is composed of epithelial cells, and these are

continually being added to by the growth of new cells immediately over the papilla, the constant

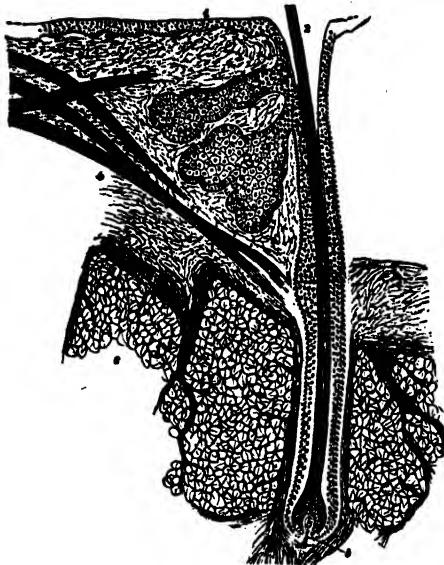


Fig. 1.—LONGITUDINAL SECTION THROUGH A HUMAN HAIR.
1. Epidermis. 2 Mouth of hair follicle. 3 Sebaceous follicle.
4 Musculus arrector pili. 5 Papilla of hair. 6 Adipose tissue.

addition causing a thrusting upwards of cells previously formed, which latter become modified in appearance and converted into portions of hair substance proper. In this way a hair is continually growing as long as the hair follicle and papilla remain functionally active. After a while the two

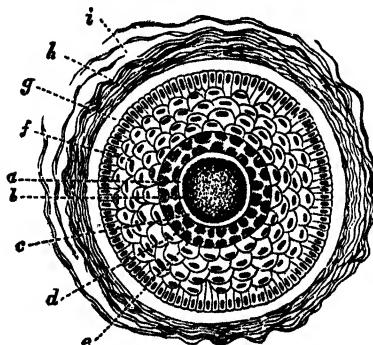


Fig. 2.—CROSS SECTION THROUGH A HUMAN HAIR AND HAIR FOLLICLE.

a. Marrow of hair. b. Cortex of hair. c. Cuticle of hair. d. Huxley's layer of inner root-sheath. e. Henle's layer of inner root sheath. f. Outer root sheath. g. Glassy membrane. h. Fibrous coat of hair sac. i. Lymph spaces in the same.

latter undergo degeneration, and then a new papilla and new follicle will be found to take their

place. The hair itself consists of the delicate cuticle composed of a single layer of imbricated scales, internal to which are the fibres of the hair substance, and most internal of all is what is called the *marrow of the hair*. Two other structures deserve mention in connection with the hair follicle. There is, in the first place, the sebaceous gland or follicle depicted in Fig. 1, which secretes an oily substance which serves to keep the hair glossy; in the second place, there is the group of unstriped muscular fibres (*musculus arrector pili*), which by their contraction drag upon the hair follicle and make the hair stand erect. This system of muscles is much more highly developed in the lower animals than in man.

Hair-dressing. Savage races, and up to a late period civilised nations also, exhibit great variety in their modes of dressing the hair. Among the more remarkable peculiarities may be mentioned the Chinese pig-tail and the Moslem practice of shaving the head with the exception of a small tuft by which the wearer may be lifted into Paradise. But these monstrosities appear natural and simple beside the head-dresses in vogue in Europe in the 18th century, in which the French set the fashion. The tax on hair-powder and the taste for simplicity in dress which sprang up with the progress of democracy resulted in the abandonment of these absurd fashions.

Hair Dyes. The practice of dyeing the hair prevailed among savage races in ancient times, and is still resorted to by those who fancy that they thereby add to their personal attractions or wish to appear younger than they are. Vegetable dyes are commonly used by savages, and are also in favour with the fair sex in China and other Eastern countries; but, with the progress of civilisation, mineral preparations are found more effective. These generally consist of a solution of oxide of silver, mercury, bismuth, lead, or some other metallic salt. Most, if not all, are injurious.

Hair Powder, a scented white powder, which was sprinkled on the wigs and hair-dresses (q.v.) worn in the 18th century. Notwithstanding a law that it should be made exclusively of starch, flour was much employed in its preparation, and in 1746 a large number of hair-dressers were heavily fined for using adulterated powder. A tax imposed in 1795 was at first a fruitful source of revenue, but it led to the disuse of hair powder and was repealed in 1869. Hair powder is still often worn by footmen, and sometimes forms a part of fancy-dress costume.

Hairs (on plants) are modified cells of the epidermis, either on roots, stems, or leaves. Though each hair originates in a single cell, they often become multicellular, assume various forms, and perform several very different functions. The stems of mosses (q.v.) give off root-hairs which branch freely and bear gemmæ. The sporangia of ferns, and perhaps the ovules in such cases of superficial placentation as poppies, are hairs or *trichomes*, as they are termed in general morphology. Hairs generally originate adventitiously, and those

on the roots of flowering-plants are unicellular and exhibit nutatory movements. It is by means of these root-hairs that most flowering-plants take in their liquid food. Hairs occur generally on bud-scales and young stems and leaves, protecting them from radiated cold and perhaps damp, though such structures, as in the hazel and beech, often lose these hairs later, being, as it is termed, *glabrescent*. Hairs are particularly common in certain natural orders, such as the Labiate and Boraginaceæ, and they occur thickly on some plants characteristic of very dry situations and also on water-side plants, but not generally on actual aquatics. Thus it has been suggested that they act as a protection against unwelcome guests in the form of crawling, leaf-eating, or honey-stealing slugs or insects. Those which occur commonly on the outer surface of the calyx do probably perform such a function in addition to the protection of the young flower-bud. Among the chief forms assumed by hairs are the "glandular" or knobbed, which may be unicellular or multicellular, the *moniliform*, or necklace-like, the *peltate* and *stellate*, which, again, may consist of one or more cells, and the *squamose*, or scale-like, as in the chaff-like bodies on the leaf-stalks of many ferns. Hairs often serve as receptacles for certain bye-products of metabolism, such as the sticky substance exuding from those of species of *Lychnis*, *Silene*, *Saxifraga*, etc., or the formic acid of the nettle. The stinging-hairs of the latter are single cells with sharp hooked points, and pressed upon by surrounding epidermal and hypodermal cells. Hairy surfaces are termed *villous* if covered with scattered, long, weak hairs; *silky*, if with more numerous similar hairs, as in the Silver-leaf (*Leucadendron argenteum*) of South Africa; *pubescent*, if with numerous short hairs, as in the sage; or *hispid*, if with stiffer hairs, as in the nettle. Prickles and some bristles differ from hairs in not being exclusively epidermal in origin.

Hair Salt, or **EPSOMITE**, is the naturally occurring hydrated sulphate of magnesia, which forms the substance commonly known as Epsom salts (q.v.). It has the composition $MgSO_4 \cdot 7OH_2$, and occurs as a fibrous efflorescence at Epsom, Seidlitz, etc., and as fine silky fibres (hence the name) at Idria. The name is also sometimes applied to the naturally occurring sulphate of aluminium or *feather alum* $Al_2(SO_4)_3 \cdot 18OH_2$, which occurs in fine fibrous masses in Chili and Bohemia.

Hair-streaks, a small group of five species of butterflies belonging to the *Lycenidae* (q.v.). The "Green Hair-streak" (*Thecla rubi*), is one of the smallest. The "Brown Hair-streak" (*Zephyrus betula*) belongs to an allied genus.

Hair-tails (*Trichiurus*), a tropical genus of acanthopterygian fishes with six species, all having the body band-like, and tapering posteriorly without a caudal fin. Some of them attain a length of four feet, and *T. lepturus*, the Common Hair-tail, has occurred on our coasts.

Hajj, or **HADJ** (Arabic, "pilgrimage"), the pilgrimage to the Kaaba (q.v.) or black stone at Mecca, which every devout Mussulman is expected

to make at least once in his life. After performing this duty, he receives the title of Hajji.

Hake (*Merluccius vulgaris*), an important British food-fish of the Cod family. The elongated body is covered with minute scales, the caudal fin is separate, there are two dorsal fins and one anal, and the large ventrals are composed of seven rays. The general hue is greyish, darker on the back, and the length is from three to four feet. Like cod and ling, hake is dried and salted as stock-fish. The only other species, *M. gayi*, ranges from Chili to Magellan's Straits and New Zealand.

Hakkari, a chief branch of the Kurds [KURDS] who give their name to the mountainous district in the province of Van, Turkish Kurdistan, of which they are the original inhabitants. The Hakkari are turbulent and fanatical Mohammedan nomads, divided into a large number of sub-tribes. It was in the Hakkari country that the Oriental scholar and explorer, M. Schulz, was murdered in 1829, and most of the predatory expeditions against the surrounding Christian communities (Armenians and Nestorians) are conducted by these lawless mountaineers. (W. Ainsworth, *On the Hakkari*, in *Journal of the Royal Geographical Society*, vol. xi.)

Hakluyt, RICHARD, English clergyman and geographical writer, was born in 1553, was for some years chaplain to the English Embassy in Paris, and at the time of his death in 1616 was Archdeacon of Westminster. Between 1582 and 1589 he compiled, in three volumes, his famous collection of voyages. Many editions, some with additions recommended by Hakluyt himself, have since been published. In continuation of his work, the Hakluyt Society "for the publication of rare and valuable voyages, travels, and geographical records" was formed in London in 1846.

Hakluyt Society. [HAKLUYT.]

Hakodate, a port of Japan, situated on a peninsula in the south of the island of Yezo, is built on the slope of a hill 1,200 feet high. Since 1859 the port, which has a fine harbour, has been open to Europeans. The trade is chiefly in seaweed, sulphur, and salted salmon.

Halation. In the photography of objects or landscapes in which very bright parts are present, the high lights may frequently appear blurred and surrounded by a halo. This appearance is known as "halation," and is caused by the reflection, from the back of the glass, of light which has penetrated the film. It is often seen around windows in photographs of interiors, and in the case of dark objects, as tree trunks, branches, etc., standing out upon a bright sky. Halation may be more or less completely prevented by various devices: as (1) *backing* the plate with a black (or yellow) varnish, so that the reflection of light (or actinic light) becomes practically *nil*, and washing away the varnish before development; (2) by the use of thick opaque films; (3) by the use of films supported upon transparent paper, etc., instead of glass. Varieties of plates intended especially to obviate halation are also obtainable in the market.

Halberd, or **HALBERT**, a weapon which came into general use towards the close of the Middle Ages, and was common in the 15th and 16th centuries. It varied considerably in form, but the ordinary type was a stout wooden handle about six feet long, surmounted by a sharply-pointed blade, with a cross-piece which on one side resembled an axe, and on the other had the curve of a hook.

Halberstadt, a fine old town in Prussian Saxony, 25 miles S.W. of Magdeburg. Its history goes back to the 9th century, when it became an episcopal see; and it received municipal privileges in 998. It suffered much during the Thirty Years' War, at the close of which it went to Brandenburg. The cathedral, begun in the 13th and finished in the 14th century, was restored between 1850 and 1871. The church of Our Lady (12th century), the town-house (14th century) with wine cellars beneath it, and the Peterhof are also of interest. Gloves, cigars, and machines are made, and railway repairs undertaken.

Haldane, ROBERT (1764-1842), religious writer and preacher, was born in London. In 1798 he sold his estate at Airthrey, and, having left the Church of Scotland, soon after set up Congregational tabernacles in Edinburgh. He afterwards adopted Baptist views, and alienated many of his followers. He spent large sums on his religious work, and in 1816-17 preached with great success in Geneva and Montauban. He was the author of *The Authenticity and Inspiration of the Scriptures* and *Exposition of the Epistle to the Romans*. His brother JAMES (1768-1851) was associated with him in his work, and also became known as a controversialist, especially by his attack on the doctrines of Edward Irving.

Haldane, RIGHT HON. R. B. (b. 1856), was educated at Edinburgh and Göttingen, and called to the Bar in 1879; he entered Parliament in 1885. In 1905 he became Secretary for War in the Liberal Ministry. He has written *Education and Empire*, and *The Pathway to Reality*.

Hale, EDWARD EVERETT (b. 1822), a voluminous American writer, was born at Boston, Massachusetts, and graduated at Harvard. In 1856 he became minister of the South Congregational (Unitarian) church in Boston. He devoted much attention to Spanish-American history. Among his stories are *The Man without a Country* (1863) and *The Skeleton in the Closet* (1888). Died 1909.

Hale, SIR MATTHEW (1609-76), a great English judge, was born at Alderly, Gloucestershire. He studied under Noy at Lincoln's Inn, and made the acquaintance of Selden. He was one of Archbishop Laud's counsel when impeached, and is said also to have advised Strafford. He conformed to the Parliamentary government after the war, and about 1654 became a justice of the Common Pleas. He also sat in Parliament for his own county and Oxford University during the same period, and was a member of several committees both before and after the Restoration, in which he took an active part. He supported the Bill of Indemnity, and

made more than one attempt to obtain the "comprehension" of Dissenters within the Church. In 1660 he became Chief Baron of the Exchequer, and in 1671 Lord Chief Justice. As a judge he was renowned for his integrity, his learning, and his patience. There are lives of him by Bishop Burnet and Sir J. Bickerton Williams.

Hales, ALEXANDER OF (d. 1245), one of the most celebrated of the English school-men, known as the *Doctor Irrefragabilis*. His chief work was *Summa Universa Theologia*.

Hales, JOHN (1584-1656), one of the most enlightened thinkers of the 17th century, was born at Bath. At Oxford he became fellow of Merton and University lecturer on Greek, and he also delivered a funeral oration on Sir Thomas Bodley. In 1612 he became fellow of Eton, of which post he was deprived by the Parliament in 1649. He attended the Synod of Dort in 1618, and came back disgusted with theological prejudice. His religious opinions became very liberal, and he was charged with Socinianism. In spite, however, of his tract on *Schism and Schismatics*, Laud made him one of his chaplains and obtained for him a canonry at Windsor. When deprived of his offices under the Commonwealth he lived with great simplicity as a private tutor, and sold his valuable library to a London bookseller. *The Golden Remains of the Ever-memorable Mr. John Hales* first appeared in 1659. His complete works were first collected and edited by Lord Hailes (q.v.).

Hales, STEPHEN (1677-1761), physiologist, was born at Bekesbourne, Kent. He became fellow of Corpus Christi, Cambridge, in 1703, and afterwards held livings in Somersetshire and Hampshire (Farringdon). In 1718 he was elected F.R.S., and received the Copley medal in 1737. He was one of the founders of what was later called the Society of Arts. He lived chiefly at Teddington, of which he was perpetual curate. In 1751 he became chaplain to Prince George (afterward George III.) and clerk of the closet to his mother, who raised a monument to him in Westminster Abbey. Hales's most important work, *Statistical Essays*, deals with botany and physiology, in which he first opened the way to a correct appreciation of blood-pressure. His best-known invention was that of artificial ventilators; but he also contrived machines for distilling sea-water and for the keeping of meat and water during sea-voyages. His pamphlet against brandy-drinking was republished in 1807.

Halévy, JACQUES FRANÇOIS ÉLIAS (1799-1862), a French musical composer of Jewish extraction (his real name was Lévi), was born at Paris. He studied at the Paris Conservatoire under Cherubini and in 1819 gained the "Grand Prix de Rome," after which he went to Rome. His first operas produced in Paris were not successful, but *Clari* (1828), in which Malibran sang, made him known, though the ballet *Manon Lescaut* was the first of his works which really attracted the public. In 1835, however, in which *La Juive* was given, his name became famous. *L'Éclair*, a musical comedy (1835), showed him to have capacity for lighter music. As a professor at the Conservatoire he had

Gounod and Bizet among his pupils. In 1854 he became secretary of the Académie des Beaux-Arts, and published the *éloges* he had to pronounce there in *Souvenirs et Portraits* (1861).

Halévy, JOSEPH (b. 1827), French traveller and Orientalist, was born at Adrianople. He went through Abyssinia in 1868, and in the two following years collected for the French Academy while travelling in Yemen over 800 Sabean inscriptions. Besides descriptions of his travels, he has published *Études sur la Syllabaire Cunéiforme* (1876), *Recherches Critiques sur l'Origine de la Civilisation Babylonienne* (1877), and other works on kindred subjects.

Halévy, LUDOVIC (b. 1834), some time secretary to the Corps Législatif, collaborated with Meilhac in the librettos of Offenbach's opera-bouffes. They also wrote in conjunction several comedies such as *Frou-Frou* (1870), *Toto chez Tata* (1873), *Le Mari de la Débutante* (1879), and other light pieces. As a novelist Halévy has written *Madame et Monsieur Cardinal* (1873), *Les Petits Cardinal* (1880), *L'Abbé Constantin* (1882), and *Crigquette* (1883). His *L'Invasion* was a description of the Franco-Prussian War. He was admitted to the Académie in 1886, and died in 1908.

Half-pay, the salary paid to commissioned officers in the British army and navy while they are not actively employed. In the navy, where it is rather less than two-thirds of full pay, it forms the regular stipend of officers whose ships are no longer in commission until their appointment to a new ship. In the army officers are not placed on half-pay, except in cases of illness or inefficiency, until they have held a command as lieutenant-colonel for four years; they then receive half-pay until they are promoted.

Haliburton, THOMAS CHANDLER (1796-1865), author of *The Clockmaker; or, the Sayings and Doings of Samuel Slick of Slickville* (1837), was born in Nova Scotia. He became a member of the Assembly, and was successively Chief Justice of the Common Pleas and judge of the Supreme Court. In 1842 he retired and came to England. He was a Conservative member of Parliament from 1859 to 1864, and died at Isleworth. Among his works were an *Historical and Statistical Account of Nova Scotia* (1829), *The Old Judge* (1849), and *The Americana at Home* (1854).

Halibut, *Hippoglossus vulgaris*, the sole species of its genus, and the largest of the flat-fishes, specimens of between five and six feet long being fairly common; but it is said that fish of more than three times this length have been taken in high latitudes. The general colour is brownish on the upper surface, with markings of a darker shade and white beneath. The halibut is an important food fish, but its flesh is inferior to that of the turbot (q.v.).

Halicarnassus, a Greek city, originally known as Zephyria, and now called Budrun, is in Caria, Asia Minor. It was of Doric origin, and belonged for a time to the Hexapolis confederacy.

It became of importance under Lygdamis, a Persian satrap of Greek birth, in 500 B.C., and reached its greatest glory under Mausolus and Artemisia a century and a half later. It was destroyed by Alexander the Great, but its citadel held out against him. At Halicarnassus Herodotus, the father of history, was born. Interesting excavations were made on the site of the ancient city during the 19th century.

Halichondrina, one of the two divisions of the Cornucuporia, includes those in which the skeleton is composed of spicules, and there is little or no spongin. Its nearest allied group is that of the Keratosa. [SPONGE.]

Halifax. 1. A town in the West Riding of Yorkshire, 43 miles S.W. of York. Its name is variously said to mean "holy ways" and "holy face." The parish church (St. John's), in the Perpendicular Gothic style, was restored in 1879. All Souls' church was designed by Sir Gilbert Scott. There are forty Nonconformist places of worship. The Piece Hall, originally used as a storehouse and place of sale for manufactured goods, is now used as a market hall. The People's Park was laid out from designs by Paxton, and was given to the town by Sir F. Crossley, who, with his brother also in great part, defrayed the cost of building the orphan home and school. It was endowed largely by Mr. J. Porter. Besides its buildings and its water-works, Halifax has a flourishing Co-operative Society known as the Halifax Industrial. The carpet-works, employing more than 5,000 hands, are the largest in the world, and the manufacture of worsted and cotton stuffs is also carried on. The borough returns two members to Parliament. Pop. (1901), 104,933.

2. The chief town of Nova Scotia, is situated on the eastern coast of that peninsula. Its harbour, capable of holding the whole British navy, is one of the finest in the world, and was called by the Indians Chebucto, "greatest of havens." The dockyard is also one of the finest in British North America. The graving-dock, which is 600 feet in length, 89 feet wide at the entrance, with a depth of 30 feet, was completed in 1889. The history of Halifax does not go back farther than the middle of the 18th century. It was founded in 1749, and called after the English nobleman who had been most zealous in its protection against French projects. It was so strongly fortified as to be deemed impregnable, and soon became the most important naval and military station in British North America. Its commercial importance, however, dates only from the period following the last French war. It is now the eastern terminus of the Canadian Pacific and Inter-Colonial railways, and is an important coaling-station and starting-place for lines of steamers. Its streets are lighted by electricity, and the sanitary arrangements are perfect. The public schools are free, and to some extent compulsory. The Dalhousie University supplies advanced education. Halifax has schools for the blind and the deaf and dumb. Dartmouth is a suburb on the opposite side of the harbour.

Halifax, CHARLES MONTAGUE, EARL OF (1661-1715), an able financier and Whig statesman, was born at Horton, Northants, and educated at Westminster and Trinity College, Cambridge, where he became the friend of Newton. Having made a reputation as a wit by *The Town and Country Mouse*, a parody on *The Hind and Panther*, which he wrote with Prior, he was brought into Parliament for Maldon by Lord Dorset. For his share in the Revolution he was granted a pension by William III., and appointed to a post in the Treasury. Three years later he was made Chancellor of the Exchequer as a reward of his financial services. By taking up Paterson's scheme he laid the foundation of the Bank of England, and in 1695, with the assistance of Newton, he carried out a reform in the coinage. During the years 1697-99 he was First Lord of the Treasury, and attempted to amalgamate the old and new East India Companies. He had made many enemies, however, and was twice accused of breach of trust, but on each occasion acquitted. During the reign of Anne he lived in retirement as auditor of the Exchequer, having also been created a peer. He supported, however, the leading objects of the Whigs, and on the accession of George I. the veteran Whig was made Earl of Halifax and Lord Treasurer. He held office only a few months, and died, having survived his reputation. His claim to have been a friend to men of letters was bitterly denied by Pope, who charged him with "helping to starve" Dryden. His grandson, the third Earl (1716-71), was Secretary of State under Lord Bute, George Grenville, and Lord North, in the reign of George III.

Halifax, GEORGE SAVILE, MARQUIS OF (1633-95), the celebrated "Trimmer," was made a Viscount for his share in bringing about the Restoration. Throughout his career it was his practice to support the principle of steady government and the men of moderation when in danger of being overborne by royal tyranny or popular clamour. Thus in 1675 he opposed the Test Bill, the repeal of which and the *Habeas Corpus* Act when demanded by James II. he likewise withheld. It was his eloquence which in 1679 procured the rejection of the Exclusion Bill by the House of Lords. From 1682 to 1685 he was Lord Privy Seal, and, though dismissed, was appointed by James II. to treat with William of Orange. That king had equal confidence in him and restored him to his office; but he soon found it necessary to go into opposition. His last notable act was his opposition to any censorship of the press. His *Character of a Trimmer* forms Halifax's apologia.

Halifax, VISCOUNT. [WOOD, SIR CHARLES.]

Haliotidae, a family of Gastropoda of which *Haliotis* is the type; its popular name is the "Venus' Ear Shell" (q.v.).

Haliphysema, an animal which formed one of the principal members of the problematical group *Gastræadae*; it is, however, now known to be a Protozoan.

Halitherium, an interesting genus of extinct

Sirenia (q.v.), less specialised than their living allies, the dugongs and manatees. Remains have been found in Miocene and early Pliocene rocks in Suez, Malta, Italy, France, Darmstadt, Germany, Belgium, and the Red Crag of Suffolk. Halitherium had tusk-like incisors in the upper jaw, as in the dugongs, but its molars resembled those of the manatees. It had short, broad nasal bones and a rudimentary thigh-bone and socket.

Hall, BASIL, naval officer, explorer, and author, born in 1788, was a son of Sir James Hall, Bart., of Dunglass. He entered the navy in 1802, served as a lieutenant in the *Endymion* in covering the retreat of Sir John Moore's army in 1809, and became a commander in 1814, and a captain in 1817. As a commander in the *Lyra*, 10, he accompanied Lord Amherst's embassy to China, and on his return published *A Voyage to the Western Coasts of Corea*, etc. (1817). He then made a long tour on the Continent and travelled extensively. His experiences are embodied in numerous works, among which may be mentioned *Extracts from a Journal written on the Coasts of Chili, Peru and Mexico* (1823), *Travels in North America* (1828), and *Patchwork* (1841). He died in 1844.

Hall, CHARLES FRANCIS, Arctic explorer, was born of humble parentage in New Hampshire, United States of America, in 1821. After having been in turn blacksmith and journalist, he lived for several years among the Esquimaux and gained so much valuable Arctic experience that in 1871 he was placed by the American Government in charge of an expedition which, in the *Polaris*, set out on an attempt to reach the North Pole. At Polaris Bay, on the Greenland coast, he died in November, 1871. The story of the expedition was published by the United States Government.

Hall, CHRISTOPHER NEWMAN (b. 1816), a Congregationalist preacher and writer, was born at Maidstone. Having graduated with distinction at London University and gained the law fellowship, he preferred entering the ministry to going to the bar. In 1854 he left the Albion Congregational Church for Surrey Chapel, now called Christ Church, Lambeth. His *Autobiography* appeared in 1898. Among his devotional works are *The Call of the Master* (1855) and *The Man Christ Jesus*. He died in 1902.

Hall, JOSEPH (1574-1656), the satirist, was born at Ashby, Leicestershire, and educated at Emmanuel College, Cambridge. He took orders and became successively incumbent of Halstead and Waltham, Dean of Worcester, and Bishop of Exeter (1627) and Norwich (1641). He went with James I. to Scotland in 1617, and was one of the English deputies at the Synod of Dort, where he preached charity. He was distrusted by Laud and had to complain to the king of the spies set on him by the archbishop. He was imprisoned by the Parliament, and when released was driven out of his palace at Norwich, his last days being passed in poverty at Higham. His satires called *Virgidi-miarum* (1597-98) were some of the earliest in the language, and aroused the jealousy of Marston. Besides this he wrote a prose satire (*Mundus alter*

et Idem) in Latin against the Roman Catholics, and published devotional works which are highly praised by Fuller.

Hall, MARSHALL (1790–1857), the author of the accepted method for restoring respiration after apparent drowning, was born at Basford, Notts., being a son of Robert Hall, who first used chlorine for bleaching cotton. Having graduated at Edinburgh and visited the medical schools at Paris, Göttingen, and Berlin, he began to practise as a physician at Nottingham, but left it for London in 1826 and practised there till 1853. He made important discoveries in connection with the reflex action of the spinal system, and published able works on diagnosis, the circulation of the blood, and other medical subjects. His memoirs, with a biography, were written by his widow.

Hall, ROBERT (1764–1831), the Baptist preacher, was born near Leicester. He was educated at the Bristol Academy and at King's College, Aberdeen, and became intimate at the latter place with Sir James Mackintosh. In 1785 he began his ministry at Bristol, where he stopped for five years. In 1791 he came to Cambridge, and increased his reputation as an orator by his sermon on *Modern Infidelity* (1800). For two periods of several months (in 1804–5 and 1805–6) he lost his faculties, and soon after his recovery left Cambridge for Leicester. Here in 1817 he delivered his famous sermon on the death of Princess Charlotte. Besides sermons he published *An Apology for the Freedom of the Press* (1793) and other works.

Hall, or HALLE, EDWARD (d. 1547), the chronicler, was born about 1498 in Shropshire, and was educated at Eton and King's College, Cambridge. He then went to London to enter upon a legal career. He became Common Sergeant in 1532, and was several times reader at Gray's Inn. Some years afterwards he entered Parliament, where, as member for Bridgewater, he supported Crown interests. His *Chronicle*, entitled *The Union of the Noble and Illustris Families of Lancastre and York*, was first printed in 1542, but this edition is very rare. In 1550 a more complete one was issued, and in 1809 a reprint was published by Sir H. Ellis.

Hallam, HENRY (1777–1859), the historian, was born at Windsor and educated at Eton and Christ Church, after which he went to the bar. He did not, however, long continue to practise, but, having obtained a Commissionership of Stamps and having property besides, gave his whole attention to literature. In 1818 he published his *View of the State of Europe during the Middle Ages*, which immediately established his reputation for learning and research. His *Constitutional History of England*, which appeared in 1827, covered the period from the accession of Henry VII. to the death of George III. He had in his former work in some measure dealt with the earlier constitutional history, but his account of this formative period has been superseded by Dr. Stubbs's works. Hallam's book is still the standard authority on Tudor and Stuart

constitutional history. Hallam's last great work, the *Introduction to the Literature of Europe in the 15th, 16th and 17th Centuries* (4 vols. 1837–39), showed the same accuracy and learning as the previous publications, and had the same defect of colour. In spite of an impartiality beyond praise in those *Quarterly* and *Edinburgh* days, he showed decided Whig leanings, though of an historical rather than of a practical character.

ARTHUR HENRY HALLAM, the friend of Tennyson, was born in 1811. He died at Vienna in 1833, when on a Continental tour with his father. Among his *Remains* the best specimens of his work were his *Essay on Cicero*, his attack on Rossetti's symbolic criticisms of Dante, and his review of Tennyson's first poems.

Hallamshire, a manor in the S.W. of Derbyshire, the boundaries of which are now difficult to define. It is thought to have included the parishes of Sheffield and Ecclesfield. A parliamentary division of the West Riding now bears this name.

Halle (Halle an der Saale), a city of Prussian Saxony 20 miles N.W. of Leipzig. It is built upon several islands on the Saale, and is at the junction of several railways. It is a very old town. In the 10th century it belonged to the Archbishop of Magdeburg, in the 13th was one of the leading Hanse Towns, but after a struggle of five centuries again in 1478 it fell under ecclesiastical power. At the Peace of Westphalia Halle went to Brandenburg, and in 1694 Frederick I. of Prussia founded its celebrated university. This was suppressed by Napoleon, but re-established in 1815, when it was incorporated with Wittenberg. It was long a theological stronghold, but at length became a centre of Rationalism. Chief among the buildings of the city are St. Mary's church (16th century) and the Gothic church of St. Maurice, which dates from the 12th; the remains of the Moritzburg, the former residence of the Archbishops of Magdeburg; the University library, the Red Tower (276 ft. high), and Roland statue in the market-place; the Town Hall and the Francke Institution. [FRANCKE.] Halle is celebrated for its salt springs, worked by the "Halloren" from the beginning of the Middle Ages. These men are supposed to be descendants of the original inhabitants, and have peculiar customs and immunities. Machine-making and sugar-refining are the chief industries. At Halle was born Handel the composer.

Hallé, SIR CHARLES (b. 1819), the well-known pianist, was born at Hagen, Westphalia. He studied and established himself in Paris, but after the outbreak of the revolution of 1848 came to England, where he made Manchester his headquarters. He did much to popularise the great masters, and was knighted in 1888. In the same year he married Madame Norman-Néruda, the violinist—born in 1840. She was an organist's daughter, and was brought before the public at a very early age, playing first in London at the age of ten. Her first husband was a Swedish musician named Norman. Sir C. Hallé died in 1895.

Halleck, FITZGREENE (1790-1867), an American poet, was a native of Guilford, Connecticut. He was for some time private secretary to J. J. Astor, who left him a small annuity which enabled him henceforth to lead a retired life. In 1822 he paid a visit to Europe. His chief poems were *Fanny*, a satire, and *Young America* (1865). His *Life and Letters* were edited by James Grant Wilson, who also collected his works.

Halleck, HENRY WAGER (1815-72), an American general, was born at Westerville, New York State, and entered the army in 1839. He served with distinction in the Mexican War, and rendered useful services in organising the new state of California. In 1854 he left the army for a time and became a lawyer, but when the Civil War broke out he was made a major-general and given the command in Missouri. In May, 1862, he captured Corinth, and the next July became commander-in-chief of the Federal army. This post he held till March, 1864, when he became chief of the staff under Grant. His *Elements of War and Military Science*, written after a tour in Europe when he was quite a young man, were for many years a standard text-book of tactics.

Haller, ALBRECHT VON (1708-77), anatomist and poet, was born at Berne. He graduated in 1727 at Leyden, and also studied at Tübingen, London, Paris, and Oxford. After making a reputation for himself by botanical and anatomical research at Berne, he was appointed the first professor in these subjects and medicine at Göttingen in 1736, where he remained till 1753. In his retirement at Berne he continued his scientific labours, and also took part in public affairs and wrote romances. Besides his botanical and anatomical works, he wrote poems which were republished in 1882 and were the first sign of the revival in German literature. His life was written by Blüsch and Hirzel (1877), and Frey (1879).

Halley, EDMUND (1656-1742), an English astronomer, was born at Haggerston and educated at St. Paul's school and Queen's College, Oxford. He began his astronomical studies as a schoolboy, and was elected to the Royal Society at the age of 22. He had previously been to St. Helena and made a catalogue of the southern stars. In 1684 he made the acquaintance of Newton, and found that he had been anticipated by him in his discovery of the nature of the centripetal force in the solar system. He formed a close intimacy with Sir Isaac, and defrayed the cost of publication of the *Principia*, besides seeing it through the press. He also made charts of the winds on the tropical seas and of the tides in the English Channel. In 1703 he became professor of astronomy at Oxford, having previously been refused that post owing to his supposed materialistic views. From 1713 to 1721 he was secretary of the Royal Society, and in 1720 became Astronomer Royal. The comet which he observed and whose return he predicted, has perpetuated his name. Besides the discoveries mentioned, Halley made many others, such as those relating to the magnetic variation of the compass

and the acceleration of the moon's motion. His *Tabula Astronomica* appeared in 1749.

Halley's Comet. This comet was observed in 1682 by the astronomer Halley, who had powerful reasons for believing that it was the same comet that had appeared previously in the years 1607 and 1531. He inferred that this heavenly body moved in an elliptical orbit round the sun in the same manner as any one of the planets, but with a far larger orbit. His ideas being confirmed by careful calculations, he ventured to predict that the comet would next appear in 1757 or 1758, possibly retardation from unknown causes delaying it till 1759. The mathematician Clairaut investigated the subject in greater detail in 1758, and further predicted that the comet would first reach its nearest position to the sun about the middle of April, 1759, adding that his calculations might be in error about a month either way. The comet actually appeared on Christmas Day, 1758, and was closest to the sun on the 12th March, just a month earlier than the day which Clairaut had calculated to be the most likely. It has since been shown that the magnificent comet appearing B.C. 11 was identical with Halley's. In 1910 great interest was aroused by its return. [COMET.]

Halliwell-Phillips, JAMES ORCHARD (1820-89), the Shakespearian scholar, was born in Chelsea. He spent some time at Cambridge, making much use of the college libraries. His industry and learning procured his election as F.R.S. before he was nineteen. Among his numerous antiquarian publications the chief was a *Dictionary of Archæo and Provincial Words, Obsolete Phrases, Proverbs and Ancient Customs* (1846), compiled when still a young man. The great work of his life was, however, his edition of Shakespeare, to which a life was prefixed (1853-65). He afterwards also published *Outlines of the Life of Shakespeare* (7th edit., 1887). To him chiefly was due the purchase of the poet's estate by the Corporation of Stratford and the formation of the Shakespeare Museum. In 1872 he assumed the name of Phillips, his wife's grandfather.

Hall-marks, or PLATE-MARKS, embossed symbols stamped on articles of gold and silver to show the quality of the material. The name is derived from the Hall of the Goldsmiths' Company, to whom the regulation of the process was entrusted. The symbols are the following: (1) The standard mark; this consists of a crown and the figure 22 for English gold of 22 carats, a crown and the figure 18 for gold of 18 carats, etc. (2) The mark of the assay town—a leopard's head for London, an anchor for Birmingham, etc. (3) A mark showing that duty has been paid—the head of the ruling sovereign. (4) The date mark—a letter of the alphabet, which changes each year. (5) The maker's mark—consisting usually of the initials of his Christian name and surname. To these (6) the workman's mark is sometimes added.

Hallowe'en, the 31st of October, the eve of All Hallows' or All Saints' Day. Popular superstition ascribes exceptional power to witches and

fairies at this season. In Scotland it was formerly marked by festivities and divinations graphically described in Burns's *Hallone'en*.

Haloes are circles of light around the sun or moon, due to the presence of ice-crystals in the air. They are not usually distinguished from coronæ, which, strictly speaking, are smaller circles appearing round the sun or moon when seen through a faint cloud or mist. The formation of haloes is very similar to that of rainbows; it is due to the refraction of light into the ice-crystal, and its reflection from the inner surface back through the crystal at a definite angle to its original path. A spectator placed at a certain position will receive light that comes from a certain set of crystals placed symmetrically with regard to him and the sun or moon. Such crystals will lie in a circle whose centre is in the line between his eye and the source of light, and he therefore sees a circle of light surrounding that source. The angular distance of the circle from the sun or moon will depend upon the arrangement of the ice-crystals. It is about 22° usually, but secondary haloes of 46° and even tertiary of about 90° have been observed. The different refrangibilities of light of different colours causes primary and secondary haloes to be tinged red on the inside, and blue on the outside edges. Tertiary haloes appear to be uncoloured, but no satisfactory reason has yet been assigned for this deficiency. [RAINBOW, MIRAGE.]

Halogens. This term is applied to the four elements, fluorine, chlorine, bromine, and iodine, which together form a natural group in which the physical and chemical properties exhibit a well-marked gradation. Thus the two first elements are gases, chlorine being, however, condensable to a liquid at moderate pressure and cold. Bromine is a liquid under ordinary conditions, while iodine is a solid substance; fluorine has a very pale green colour, chlorine is of a marked yellow green, bromine is dark red, and iodine deep violet. The atomic weight increases similarly thus: F=19, Cl=35.5, Br=80, I=127. With the alkaline metals they form a series of salts resembling ordinary salt—sodium chloride (NaCl), and from this the general term is derived (*halo*, salt; *gennaō*, to produce). In their various chemical reactions, the heat of formation of their compounds, etc., the same gradation as is noticed above is still more strikingly visible, and is what would be predicted from the position of these elements in the arrangement of the elements according to the *Periodic Law* (q.v.).

Haloxylene, or BLECKMAN'S POWDER, is an explosive compound of sawdust freed from resinous matter, with saltpetre, charcoal, and sometimes also yellow prussiate (ferrocyanide) of potash. The substances are mixed, slightly moistened with water, crushed, ground, pressed to a cake, and then grained like gunpowder. The ordinary proportions are: sawdust, 9 parts; charcoal, 3 to 5 parts; saltpetre, 45 parts. The ferrocyanide is added if very quick explosion be desired.

Hals, FRANS (d. 1666), founder of the Dutch school of *genre*-painting, was born between 1580

or 1584, probably at Antwerp, but passed most of his life at Haarlem. His private life was not exemplary, and he fell into poverty. He received, however, a pension from the municipality, and was buried in St. Bavon's church. He was a great master of the *technique* of portrait-painting, but his flesh-painting is considered somewhat crude, and his shading rather heavy. Vandyck is said to have visited him and praised him very highly. The chief work of Hals is his group of the Society of Archers in their Hall at Delft. His *Mandoline Player* at Amsterdam is also a good specimen of his portraiture. Among his pupils were Van der Helst, Ostade, Brouwer, and Wouvermans. He is generally known as Hals the Elder to distinguish him from his son (d. 1669) and his brother Dirk Hals (d. 1656).

Halymites, or the CHAIN CORAL, an extinct genus of corals, very common in the Wenlock limestone and some other Silurian rocks.

Ham, the second son of Noah, is described in the book of Genesis as the ancestor of the Arabians, Egyptians, Ethiopians, and other southern races. The name is Hebrew, and means "to be hot." [HAMITIC RACES.]

Ham means literally the "bend of the leg," but the name is now almost entirely confined to the cured thigh of the hog. The process of curing is as follows: After the meat has been well rubbed with salt, it is placed for some days on a bench or in a covered tub until the brine has disappeared. It is then rubbed a second time, some saltpetre or sugar being now added to the salt, and is afterwards replaced on the bench or in the tub for a week, after which the drying takes place. The smoking is usually carried on in a smoking-house containing two or three storeys. A wood fire is lighted in the lowest storey, and the smoke penetrates through the ceiling to those above in which the hams are hung. This operation lasts for about six weeks, during which the fire is never allowed to go out. The hams smoked in Westphalia are considered the best. An immense number of hams are packed for exportation at Chicago and in the neighbourhood.

Ham, WEST, a borough—practically a suburb of London, on the Thames, in the county of Essex. The chief industries are ship-building and silk-printing. Many of the inhabitants are employed in the Victoria and Albert Docks. It consists of two parliamentary divisions, each returning one member. Pop. (1901), 267,308.

Hamadan, a Persian town, in the province of Irak Ajemi, at the foot of Mount Elwund, 180 miles W.S.W. of Teheran. It is supposed to stand on the site of the ancient Ecbatana, and contains the tomb of the philosopher Avicenna (q.v.). Leather is manufactured, and it is the centre of the carrying trade between Teheran and Ispahan on the east and Bagdad and Erivan on the west.

Hamadryad [NYMPH]. Hamadryad is also used as a popular name for *Cynocephalus hamadryas* [BABOON], and for the cannibal snake,

Ophiophagus claps, of the same family as the cobra, which it exceeds in size.

Hamama (HAMEMA), a powerful Arabo-Berber people of Tunisia, dominant in the southern districts along the northern shores of the Shotts Jerid and Gharsa between the Gulf of Cabes and the Algerian frontier, and extending beyond the Gafsa oasis northwards to the Freshish territory. Before order was restored by the French occupation (1882), the Hamamas were practically independent of the Bey, and maintained a chronic state of warfare with all their neighbours, their marauding expeditions ranging far into the Algerian Sahara. In those days every Hamama male child was placed on the very day of his birth on the back of a horse, and saluted with the words, "Saddle and bridle and life on Islam," meaning that his inheritance would be a horse and arms with which to earn his bread by plundering his Mohammedan neighbours. At present they find it more profitable to earn their bread by acting as caravan guides, cultivating date plantations, and seeking employment as labourers and porters in Tunis, Bona, and other large towns. (*French Official Reports*, 1886-92.)

Hamann, JOHANN GEORG (1730-1788), German man of letters, was born at Königsberg, in Prussia. After leading a desultory and wandering life, he obtained a post in the excise at Königsberg in 1767. He died at Münster. The mystical tendency of his writings was opposed to the spirit of the age in which he lived, but he exercised considerable influence over Herder, Jacobi, Richter, and other eminent writers.

Hamburg, a state of the German Empire, comprising an area of 158 square miles, and including the city of Hamburg and the towns of Bergedorf and Cuxhaven. The city of Hamburg stands on the north bank of the Elbe, about 75 miles from its mouth and 177 miles N.W. of Berlin. It was founded by Charlemagne in 808. In 1190 it received an imperial charter, granting it freedom from external jurisdiction and other privileges. It was one of the earliest members of the Hanseatic League (q.v.), and from the middle of the 13th century onwards rose rapidly in commercial importance. It was very active in suppressing piracy in the North Sea. In 1402 a great battle took place off Heligoland, in which the robber chieftain Stortebeker was defeated by Simon of Utrecht, a Hamburg alderman, whose grave, adorned with symbolical sculpture, remains outside St. Nicholas' church. Stortebeker's goblet, a yard and a half high, is also preserved among the local antiquities. In 1510 Hamburg became an imperial town. During the 16th century it showed a disposition to break loose from the traditional policy of the League, which was ill adapted to the altered conditions of the age. In 1567 it concluded an independent treaty with the English Merchant Adventurers, which, in spite of the opposition of the League and the Emperor, conduced greatly to the prosperity of the town. It was one of the three cities which continued to represent the League after the Thirty Years' War, although they had

now lost most of their ancient privileges. The progress of Hamburg continued with little interruption until the early years of the 19th century. From 1806 to 1814 it was occupied by Napoleon's general Davout, who was besieged here by the Russians in 1814. Its trade, which had greatly declined during the French occupation, began to revive in 1815, when it joined the German Confederation. In 1842 a great part of the city was destroyed by fire. In 1888 Hamburg was compelled to join the German Zollverein, thereby losing its privileges as a free port. The part of the town which was rebuilt after the great fire contains many handsome houses, but the old town is composed of narrow and irregular streets, intersected by numerous waterways, which afford communication with the Elbe and its tributary the Alster. The ramparts enclosing the town are now laid out as public gardens and walks. Of the ancient buildings which survived the fire the most noteworthy is the church of St. Catherine, built in the 14th century. The other public buildings include the churches of St. Nicholas (designed by Sir Gilbert Scott) and St. Michael, both remarkable for their lofty spires, the town-house, the "school-house" (comprising a large library and a natural history museum), the exchange, and the picture gallery. There is also an important school of navigation, to which an observatory is attached. The industries include sugar-refining, cigar-making, spirit-distilling, brewing, engineering, and ship-building. The importance of Hamburg is, however, almost entirely derived from its position as a great commercial centre. The dock accommodation at Cuxhaven has recently been improved, and, besides the Elbe, several new railways facilitate communication with the interior of Germany. The trade of Hamburg extends to all parts of the world, that with Great Britain being especially active. Next after Great Britain, the countries with which Hamburg has commercial transactions of the greatest magnitude are the United States, France, Holland and Belgium, Central America, Russia, East Indies, and China, and the east and west coasts of Africa. The chief article of commerce is coffee, next after which rank sugar, wine, spirits, tobacco, butter, hides, leather, and woollen and cotton goods. As a centre for the exchange of money its importance is second to that of London alone. Hamburg is a great port for emigration.

Hamelin, FERDINAND ALPHONSE, French seaman, born in 1796, was the son of a naval officer who distinguished himself during the wars of Napoleon. He for a time commanded the French fleet in the Black Sea in 1854, and in 1855 was made Minister of Marine. He held that appointment, save during two short intervals, till 1860, and, having reached the rank of full admiral, died in 1864.

Hameln, a town of Hanover, on the Weser, 25 miles S.W. of Hanover. It was a member of the Hanseatic League, and was formerly well fortified. Machine-making, brewing, and salmon-fishing are carried on extensively, and leather and

paper are manufactured. Among the many ancient buildings in the town is that shown as the residence of the "Pied Piper" celebrated in Browning's poem, an imposing edifice with heavy mullioned windows and a quaintly-carved gable.

Hamerling, ROBERT (1830-1889), an Austrian poet and man of letters. In 1866 his health broke down, and he passed the remainder of his life at Gratz in a state of physical prostration. His poems include *Sinnen und Minnen* (1860) and other volumes of lyrics, but his best works are his satires, *Ahasuer in Rom* (1866), *Der König von Sion* (1869), and *Homunculus* (1888).

Hamian (HAMEYAN), a large Berber people, province of Oran, Algeria, where they occupy nearly all the territory south of the Shotts between Geryville and the Moroccan frontier. There are two divisions, Hamian-Gharaba and Hamian-Sheraga (West and East Hamian), with numerous *ferkas* (clans), some of whom, after an unsuccessful revolt against the French, withdrew to Morocco in 1881. The Hamians are great traders, and every year equip a caravan of 6,000, 8,000, and even 10,000 camels for the Gurara market in Central Sahara, where corn, cotton goods, crockery, and other European wares are exchanged for ostrich feathers, salt, gold-dust, and (formerly) slaves. There are two other Berber tribes of this name in Oran, one in the Habra basin south of Sidi bel-Abbes, the other (Hamian el Melah) in the Arzen district near the coast.

Hamilcar, surnamed BARCA ("lightning"), a Carthaginian general, is first heard of in 247 B.C., when he was appointed commander of the Carthaginian forces in Sicily. He was then still a young man. At the time of his arrival the Romans had gained possession of the whole island, excepting Drepanum and Lilybeum. Landing unexpectedly on the north coast, he occupied Mount Ercte, near Panormus, and from this centre led numerous expeditions against the Romans, while his fleet laid waste the shores of South Italy. In 244 he suddenly left Ercte, and sailing along the coast, seized the town of Eryx, a point from which he was able to continue his tactics with even better success. Here he remained until the defeat of the Carthaginian fleet under Hanno off the Aegates islands (242) brought the First Punic War to a close. A revolt of the mercenary troops under Spendius and Katho, assisted by the native Africans, which broke out in 241, was finally quelled by Hamilcar in 238. At home he allied himself with the Democratic party, as a counterweight to the intrigues of his aristocratic opponents, led by Hanno. Sent to Spain in 236, he formed the design of founding a Punic dominion in that country, which might serve as a basis for future operations against Rome. Little is known concerning his movements in Spain, but the distance to which he carried his arms may be judged from the fact that he perished in a combat with the Vettones, who inhabited the region between the Tagus and the Anas (Guadiana).

Hamilton. 1. A town of Lanarkshire, on the Clyde, 10 miles S.E. of Glasgow. It is one of the

five Falkirk parliamentary boroughs. The inhabitants are chiefly engaged in mining. Here is Hamilton Palace, the seat of the Dukes of Hamilton, a portion of which dates from 1594. In the neighbourhood are the remains of the ancient castle of Cadzow. Pop. (1901), 34,000.

2. A town in Canada West, on Burlington Bay, at the western extremity of Lake Ontario, 40 miles S.W. of Toronto. Several of the chief railways in Canada converge at this point, and the manufacture of iron implements, sewing-machines, and cotton and woollen goods is carried on extensively. Hamilton is a see of both the Anglican and Roman Catholic Churches.

Hamilton, ALEXANDER (1757-1804), American statesman, was born at Nevis in the West Indies, and received his education at Elizabethtown, New Jersey, and Columbia College, New York. He had hardly reached his 19th year when he published an able series of papers in support of the rights of the American colonists. When the war with the mother country broke out, he received a commission as captain of artillery, and in 1777 was selected by Washington as his aide-de-camp. After the close of the war he practised as a lawyer in New York. He represented the state of New York in the Congress of 1782, and took a leading part in the proceedings of the Convention at Philadelphia in 1787, in which a final decision was arrived at as to the form to be given to the constitution. In accordance with a scheme formed by Hamilton a series of essays in support of the constitution, which afterwards became widely known as *The Federalist*, was published in the New York *Daily Advertiser*. More than half the essays were written by Hamilton himself. In 1789 he became secretary of the Treasury in the new Federal Government under Washington. This post he resigned in 1795, after completely restoring the public credit by his skill as a financier. He still remained the virtual head of the Federal party, and was invariably consulted whenever a difficulty arose. In 1799 he succeeded Washington as commander-in-chief of the United States army. He was killed in a duel by his political rival, Aaron Burr.

Hamilton, SIR CHARLES, BART., elder brother of Sir Edward Hamilton, Bart., was born in 1767 and entered the navy in 1776. He shared in Cornwallis's action in 1780, and in the operations by Nelson off Calvi in 1794. In 1799 he was second in command of the expedition to the Helder, and in 1800, as commodore on the coast of Africa, captured Goree. He became a rear-admiral in 1810, a vice-admiral in 1814, and an admiral in 1830. From 1810 to 1814 he was commander-in-chief in the Thames, and from 1818 to 1824 governor and commander-in-chief at Newfoundland. He died in 1849.

Hamilton, SIR EDWARD, BART., British naval commander, was a son of Captain Sir John Hamilton, R.N., and was born in 1772. In command of the *Surprise*, 32, he took or destroyed above 80 vessels, but it was in 1799 that he gained his greatest fame by cutting out with his boats from under the fire of nearly 200 guns in the batteries

at Puerto Cabello, the Spanish (formerly British) *Hermione*, 44. Hamilton, who was severely wounded, was in due course made a knight, a K.C.B., and a baronet; but, in the meantime, he had been captured by the French, and had been dismissed the service for ill-treatment of his men. He was, however, exchanged and restored, and died in 1851, having been for thirty years a flag-officer.

Hamilton, EMMA, LADY (1763-1815), notorious through her connection with Lord Nelson, is said to have been the daughter of a labourer named Lyon and to have been born in Cheshire. In 1791 she was married to Sir William Hamilton, the English ambassador at Naples, and it was during her residence at that court that Nelson made her acquaintance. Their daughter, Horatia, was born in 1801. Lady Hamilton died, in extreme poverty, at Calais.

Hamilton, PATRICK (d. 1528), a Scotch divine, was probably born towards the close of the 15th century. After studying at the universities of Paris and Louvain, where he imbibed the doctrines of the Reformation, he proceeded in 1523 to that of St. Andrews, but his Lutheran tendencies became suspected, and in 1527 he sought refuge on the Continent. He now visited Wittenberg, where he formed friendships with Luther and Melanchthon. Soon after his return to Scotland he was summoned before Archbishop Beaton at St. Andrews, charged with heresy, and burnt at the stake on the very day of his trial. During his short life he had done much to extend the doctrines of the Reformation in Scotland.

Hamilton, SIR WILLIAM, BART. (1788-1856), a Scotch philosopher, was the son of Dr. William Hamilton, professor of medicine in the university of Glasgow. He was educated at the grammar school and university of his native town, whence he proceeded to Balliol College, Oxford, in 1807. He was appointed professor of civil history at Edinburgh in 1821, and professor of logic and metaphysics in 1836. Meanwhile he had formed a connection with the *Edinburgh Review*, in which appeared his essays on *Cousin* (1829), *Logic* (1833), and *Idealism* (1839). His edition of Reid's works was published in 1846, and in 1854 appeared the first volume of his edition of *Dugald Stewart*, which was never completed. His lectures were published after his death, in 1859-61. His power of acquiring knowledge was extraordinary and his acquaintance with philosophical literature has probably never been approached. But much of his knowledge remained unsystematised and serious inconsistencies have been detected in his doctrine, which was severely handled by J. S. Mill in his *Examination of Sir William Hamilton's Philosophy* (1865).

Hamilton's metaphysical views were in the main those of the Common Sense school of Reid and Stewart, modified to some extent by the doctrines of Kant. In opposition to the Representative theory of Reid, he brought forward his own doctrine of "Natural Realism," maintaining that our notions of an external world are immediately derived from acts of sensible perception. Beyond these

reason cannot go, so that it is impossible to prove the existence of a material world, apart from our own consciousness. All our knowledge is based on the necessity and universality of our elementary feelings and beliefs. Necessity is due either to a power or to an impotency of the mind. Our belief in existence and the intuitions of time and space are examples of the former kind. But other beliefs must be explained by the "Law of the Conditioned." Thus unlimited space and a limit to space are alike impossible conceptions, so that we are compelled to think of each object in space as limited itself, but surrounded by other objects. So, too, with regard to causation—every phenomenon must have a cause, but this cause must be itself conditioned, and to carry on the process from cause to cause would result in an infinite regress of thought. On the law of the conditioned, as applied to causation, Hamilton based our consciousness of the freedom of the will, which he regarded as the sole evidence of the existence of God. While explaining it as a direct act of consciousness, he at the same time follows Kant in making it a postulate of the practical reason.

Hamilton, SIR WILLIAM ROWAN (1805-65), Astronomer-royal for Ireland, was born in Dublin. In 1827 he became keeper of the Dublin Observatory and professor of astronomy in the university. In the following year appeared his *Theory of Systems of Rays*, in a subsequent edition of which (1833) he announced his discovery of conical refraction, based on purely theoretic arguments, but afterwards confirmed by experiment. He also published *A General Method of Dynamics* (1834), *Lectures on Quaternions* (1853), etc. Apart from his mathematical attainments, he was a poet and a linguist of some eminence.

Hamites. [HAMITIC RACE.]

Hamitic Languages, a group of languages forming a distinct and independent linguistic family, current from the remotest times throughout the whole of the Hamite domain [HAMITIC RACE] except Egypt, where it has been replaced by Arabic since the Mohammedan invasion. There are three recognised branches: (1) OLD EGYPTIAN of the hieroglyphic inscriptions and Demotic writing, still partly represented by the Neo-Egyptian or Coptic, which, though no longer spoken, is still the liturgical language of the Coptic Christians; (2) BERBERE, of which there are three main groups; *Kabyle* of Algeria; *Shluh* of Morocco, and *Tamashak* (Tuareg) of the Central and Western Sahara; (3) The so-called ETHIOPIAN, which is spoken with great dialectic diversity throughout Galla, Kaffa, and Somali Lands; amongst the Agau and other primitive peoples of Abyssinia, and by the Afars (Danakil) and Bejas of the coast lands from the strait of Bab-el-Mandeb to Upper Egypt. Aberrant members of this family are also probably the language of the Masia people west of Mounts Kenia and Kilimanjaro, and the speech of the Tibu highlanders of Central Sahara and other allied tribes in Kanem, Bornu, Ennedi, and Baele round about Lake Chad.

Hamitic belongs to the inflecting or highest order

of speech, and its affinities appear to be with the Semitic, from which it separated at such a remote epoch that it is now difficult to establish the relationship. The resemblance is rather in the identity of a common morphological base than in the coincidence of fully developed grammatical forms. The pronominal systems are certainly alike both in their roots and in the process of plural formation; internal vowel change is also a common feature, though much more highly developed in the Semitic than in the Hamitic group; both attach the pronominal elements in the same way to the persons in verbal inflexion, and both employ the same letter *t* to mark the feminine gender in the noun and verb. In Berber 'his' element is even prefixed as well as suffixed, as in *akli*, negro; and *takit*, negress.

Egyptian has been cultivated longer than any other language, and the early hieroglyphic inscriptions are the oldest specimens of writing in the world. The Berber language also was reduced to written form at a very early date [BERBER]; but none of the Ethiopian languages were ever cultivated by the nations themselves; hence their only written documents are the translations of the Bible made in recent years by the missionaries. For details see under the several headings.

Hamitic Race, one of the main divisions of the Caucasic family of mankind [CAUCASIC], whose original domain was, and still largely is, the whole of North Africa, from the Negro range northwards to the Mediterranean, and from the Red Sea westwards to the Atlantic. Under the purely conventional expression "Hamites" are thus comprised all the non-Negro primitive populations of North Africa, whose unity, however, as in the case of the Aryans, depends far more on linguistic than on physical uniformity. Nevertheless, as there was undoubtedly a primitive Aryan physical type, which may still be studied in those regions where the race has been least affected by foreign elements, so there was also a primitive Hamite type, which appears to be best preserved in some of the more inaccessible uplands of Mauritania (the Great Atlas) and of South Ethiopia (Galla and Kaffa Lands). But elsewhere the integrity of the race has been greatly modified by interminglings especially with the Semites from Arabia in the extreme east (Abyssinia, Middle and Lower Nile valleys), and in the extreme north (the Mediterranean seaboard), and with the Negroes in the extreme south (Somali and Galla Lands, and all along the Soudanese borderlands). But it is no longer possible accurately to determine the original southern limits of the Hamitic domain, although, judging from the vague and scanty ethnological data preserved in the old writers (Herodotus, Strabo, Ptolemy, Pliny), the Libyans, Gaetulians, Numidians, and Mauritanians, would appear to have ranged far less southwards than do their modern representatives, the Berbers and Tuaregs. The widespread nation of the Garamantes, whose empire centuries before the new era covered a great part of North Africa, are spoken of by Ptolemy as "already rather Ethiopians" (ii. 8), that is, as

Negroes rather than Hamites. Yet their chief strongholds, captured by Cornelius Balbus; under Augustus, were Cydamus, the present Ghadames, on the northern verge of the Sahara, and Garama, the "Old Jerma" of Fezzan in South Tripolitana. Consequently Negro, or at least Negroid, peoples must at that time have ranged northwards nearly to the Mediterranean, that is, right across to Sahara, which is at present mainly Hamite territory, where Negroes are found, only as slaves or freedmen imported in recent times from Soudan. In general it may be said that throughout the historic period the Hamites have been steadily enlarging their domain southwards, and driving the Negroes more and more into Soudan, in some parts of which, as, for instance, within the great northern bend of the Niger south of Timbuctu, several pure Hamitic (Tuareg) populations are now settled. The same movement has been in progress in the extreme south-eastern regions, where the Somal and Galla Hamites have already reached the Tana basin and the Lake Samburu district, North Masailand, regions which originally were beyond doubt well within the Negro domain. The Masai people themselves are simply Negroid Hamites, and in the equatorial lake region there are traditions of a great Hamite (Galla) empire (Kitwara), of which the present kingdoms of Uganda, Unyoro, and Karagwe are mere fragments. In still more remote times primordial infiltrations took place, by which the dead mass of Negrodom was leavened by an infusion of Hamitic blood throughout the southern half of the continent from the equator to Kafirland, and from the Indian to the Atlantic Ocean. [BANTU, WA-HUMA.]

The Hamitic type, as observed amongst the Mauritanian Berbers, approaches nearest to the Semitic, and differs in no essential respect from the primitive Aryan. Hence it is that from the anthropologic standpoint all three form nearly so many branches or varieties of an original Caucasic stock. Hence also the view accepted by many sound ethnologists that a Hamitic (Berber) element forms the substratum of the present populations of southwest Europe and parts of the British Isles. Herodotus spoke of the ancestors of the present Bejas between the Nile and the Red Sea as "the finest of men;" all travellers describe the Galla and Somali peoples as of splendid physique, and many of the full-blood Berbers are greatly superior—taller, more muscular and robust, better proportioned, and scarcely darker—than the average south European. The skin is fair in childhood, though it soon bronzes when exposed to the air; the hair is black, straight, and rather abundant; the eyes dark brown; face somewhat shorter, and its oval outline less regular than that of the Arab; nose larger, almost aquiline, and deeply sunk at the root; forehead high and straight; head distinctly dolichocephalic (long and narrow); features altogether regular and moderately orthognathous. The Hamite is fairly intelligent, superior perhaps in this respect to the Arab, he is less fanatical and narrow-minded, equally brave, and fond of personal freedom; imbued with the democratic spirit

substituting the commune for the Arab sheikh; by nature sedentary and agricultural, but in steppe lands necessarily pastoral and nomadic.

There are three main divisions: (1) the *Berbers* or *Western Hamites*, along the Mediterranean seaboard from the Siwah oasis near the Nile delta to Morocco, and throughout Central and Western Sahara, but nearly everywhere intermingled with Arabs, and in many places Arabised; (2) The *Ethiopians* or *Eastern Hamites*, mainly from about the equator to Upper Egypt, and from the coast inland to the Nile, but broken by an intruding wedge of Himyaritic Semites (South Arabians) in Abyssinia; (3) the *Egyptians* (Copts and Fellahin) all now assimilated in speech to the Arabs. For details see under the several headings.

Hamlet, the hero of Shakespeare's tragedy, was an early Prince of Denmark, whose story is related in the *Historia Danica* of Saxo Grammaticus (about 1180-1208). The leading incidents of Shakespeare's play occur in the original narrative, but, according to Saxo, Hamlet returned to England after his revenge, married two wives, became King of Denmark, and was ultimately slain in battle. Shakespeare probably derived the tale from the prose *Hystorie of Hamlet*, translated from the *Histoires Tragiques* of Belleforest, who followed Saxo. He may also have made use of an earlier play on the same subject, which is known to have existed as early as 1589.

Hamm, a Prussian town, in Westphalia, on the Lippe, 25 miles N.E. of Dortmund. The iron-foundries and wire-works give employment to a large number of the inhabitants.

Hammer is a well-known tool for supplying an impulsive force. The ordinary hammer consists of a head of steel mounted on a handle of beech or ash. The length of handle depends upon the amount of momentum required to be given up during impact. If the hammer-head is too heavy to be wielded by hand, other motive-power may be supplied, such as steam-pressure or head of water. In many mines ore is crushed by heavy cylindrical vertical rods that are lifted by water-power supplied through a water-wheel and allowed to fall on the ore placed beneath. This is the principle of the *shingling* and *tilt* hammers used in iron works. The ordinary steam hammer (q.v.) has a vertical steam cylinder, the piston of which is forced upwards by steam-pressure and so lifts a heavy block of metal. This may be dropped on to the mass of metal placed on an anvil beneath, to be wrought into shape by repeated blows of the hammer.

Hammer-head, any shark of the genus *Zygæna* with five species widely distributed, but most abundant in tropical and sub-tropical seas. The popular name is due to the fact that the front part of the head is produced so as to form a lobe on each side projecting far beyond the width of the body, and at the extremities of these lobes are the eyes. *Z. malleus*, sometimes called the Balance-fish, the best-known species, is bluish-grey above, lighter beneath. Specimens of over 13 feet long have been taken off our coast.

Hammersmith, a parliamentary borough of Middlesex, on the north side of the Thames, now forming part of London. A new suspension bridge (1887) has taken the place of the old one erected in 1827. Pop. (1901), 112,245.

Hammond, HENRY (1605-1660), an English divine, was educated at Magdalen College, Oxford, of which he was elected a fellow in 1625. He became rector of Penshurst, Kent, in 1633, and Archdeacon of Chichester in 1643. In 1645 he was appointed chaplain to Charles I., whom he attended in the Isle of Wight. His chief work was his *Paraphrase of Annotations on the New Testament* (1653).

Hampden, JOHN (1594-1643), a renowned English patriot, was descended from an ancient Buckinghamshire family. His mother was the sister of Oliver Cromwell's father. He was educated at Magdalen College, Oxford, and studied law at the Inner Temple. In 1621 he was returned to Parliament as member for Grampound. In the early Parliaments of Charles I., in which he represented Wendover—he associated himself with Eliot, Pym, and the other members who withstood the king's attempts to rule as an autocrat. In 1627 he was imprisoned for a short time for refusing to contribute to a forced loan. When Charles proceeded in 1637 to levy ship-money from inland as well as maritime towns, Hampden refused to pay the tax. He was summoned before the Court of Exchequer, and seven out of the twelve judges declared against him; but his determined attitude had already done much to encourage the opposition to the king's demands. Hampden sat in the Short Parliament of 1640, was returned to the Long Parliament as member for the county of Buckingham, and took a leading part in Strafford's impeachment. He was one of the five members whom Charles attempted to seize in the House in January, 1642. When the Civil War broke out he was placed in command of a regiment, which he had himself raised, in the army of the Earl of Essex. After distinguishing himself at Edgehill and elsewhere, he was slain in a skirmish with a troop of horse under Prince Rupert at Chalgrove Field near Thame in June, 1643.

Hampden, RENN DICKSON (1793-1868), divine, was born in Barbadoes. After a distinguished career at Oxford, he was elected fellow of Oriel College in 1814. His Bampton lectures on the *Scholastic Philosophy Considered in its Relation to Christian Theology* (1832) exposed him to an attack led by members of both the High and Low Church parties. In spite of votes of censure passed in Convocation he was appointed principal of St. Mary Hall (1833), Whye's Professor of Moral Philosophy (1834), and Regius Professor of Divinity (1836). The controversy was still raging when, in 1847, he became Bishop of Hereford. He published *Observations on Religious Dissent* (1834), and other works.

Hampshire, or HANTS, properly SOUTHAMPTONSHIRE, an English county, bounded on the N. by Berkshire, on the E. by Surrey and Sussex, on

the W. by Wiltshire and Dorsetshire, and on the S. by the English Channel. The area, including that of the Isle of Wight, is 1,070,216 acres. The Southampton Water, an inlet of the Channel, seven miles in length, runs in a north-westerly direction almost to the Wiltshire border, dividing the county into two parts. The larger division—the north-eastern—contains the ridges of the North and South Downs; the south-western is almost entirely covered by the New Forest. There are also extensive tracts of woodland in the east and south-east, forming parts of the ancient forests of Bere, Woolmer, and Waltham Chase. The chief rivers are the Itchen, and the Anton or Test, flowing into the Southampton Water, and the Avon, near the Dorsetshire border, which joins the Stour a little below Christchurch, and falls into the Channel. The climate is mild, especially in the Isle of Wight. Hampshire is mainly an agricultural county; the chief cereal is wheat; hops are also grown, and the bacon cured here is considered the best in England. The manufactures are insignificant, but the county derives some commercial importance from the excellent harbourage afforded by its seaboard, and the roadstead of Spithead, opposite Portsmouth, is one of the stations of her Majesty's fleet. Southampton and Portsmouth, the leading ports, are also the chief centres of trade. There are five parliamentary divisions, exclusive of the Isle of Wight—the North or Basingstoke, the East or Petersfield, the West or Andover, and the New Forest. The parliamentary boroughs are Winchester, Portsmouth, Southampton, and Christchurch. Among the ancient buildings may be mentioned those at Winchester (q.v.), Porchester Castle, near Portsmouth, Hurst and Carisbrooke Castles, and Netley and Beaulieu Abbeys. Pop. (1901), 798,756.

Hampstead, a municipal borough in the N.W. of the county of London. The district, once noted for its medicinal springs and now considered the healthiest place near London, is pleasantly situated on high ground and is skirted by the Heath, from which a fine view may be obtained over the neighbouring part of Middlesex. The Kit Cat Club (q.v.) held its meetings at a house on the Heath which is still standing. Hampstead has been the residence of Keats, Leigh Hunt, and other men of letters. Pop. (1901), 81,942.

Hampton, a village in Middlesex, on the Thames, 15 miles S.W. of London. At about a mile's distance is HAMPTON COURT PALACE, originally built by Cardinal Wolsey, who presented it to Henry VIII. in 1525. Considerable additions and alterations were made in the reign of William III. under the direction of Sir Christopher Wren, and the Dutch gardens, with their formal terraces and arcades, and the well-known labyrinths, belong to the same period. There is some good tapestry, and the works in the picture-gallery include Lely's *Beauties of the Court of Charles II.* and a portrait by Holbein. It ceased to be a royal palace in the reign of George II., and is now occupied chiefly by persons of rank or good position in straitened circumstances. The buildings were much injured by fire in November, 1896. Pop. (1901), 6,812.

Hampton Roads, BATTLE OF, one of the most important naval actions of the American War of Secession. On March 8th, 1862, the Confederate ironclad ram *Merrimac* approached the Federal wooden fleet that lay in Hampton Roads, and, continuing to draw near in spite of a heavy fire, rammed and sank the *Cumberland*, caused the *Congress* to strike, and created general alarm, as she appeared, on account of her armour, to be invulnerable. Next day, however, when she was preparing to renew her onslaught, she was checked and driven off by the opportune arrival of Ericsson's ironclad turret-ship the *Monitor*. It was the first battle between ironclads, and it revolutionised naval warfare.

Hamran (HOMRAN), an Arab people of East Soudan in the Upper Atbara valley, north-west frontier of Abyssinia. They have a few permanent settlements along the river banks, where they cultivate a little land, but most of them are nomads and daring hunters, pursuing the elephant, lion, and rhinoceros armed only with the sword. Many, however, are now supplied with rifles and employed by the German animal-traders to capture the large animals with which they furnish the European zoological gardens and menageries. Sir S. Baker and all other travellers who have visited them speak highly of their courage, trustworthiness, and loyalty. (Myers, *With the Hamran Arabs*, 1876; F. L. James, *Wild Tribes of the Soudan*, 1883.)

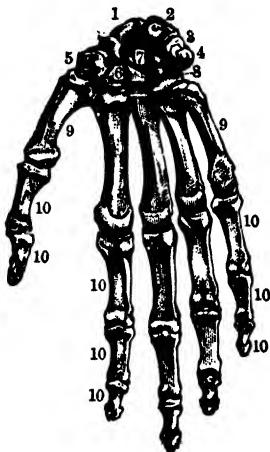
Hamster, any of the nine species of the genus *Cricetus* of the family Muridae, from the Palearctic region and Egypt. The body is stout, the limbs and tail short, and there are large cheek-pouches. The Common Hamster (*C. frumentarius*) ranges from the Rhine to Siberia, and southward to the Obi. The length, including the tail, is about a foot, and the fur, which is of some commercial value, is yellowish-brown above, and black beneath. These animals feed on grain, fruit, roots, insects, worms, and frogs, and lay up in their chambered burrows a store of corn as provision for the period after their winter sleep.

Hanau, a Prussian town in the province of Hesse-Nassau, on the Kinzig, 13 miles E. of Frankfurt. The manufactures include hats, carpets, leather, chocolate, and gunpowder, and there are breweries and an iron foundry. In the neighbourhood is the spot where the allied forces under Wiede were defeated by Napoleon in 1813.

Hancock, WINFIELD SCOTT (1824-1886), American general, was born in Pennsylvania. After serving in the Mexican and other campaigns, he joined the army of the Potomac under McClellan on the outbreak of the Civil War, and distinguished himself in the battle of Fredericksburg (1862). At Gettysburg, where he commanded the second army corps, he received a wound which disabled him for a time, but he again led the same division in the Wilderness campaign of May and June, 1864. In 1880 he was nominated Democratic candidate for the Presidency, but was unsuccessful.

Hand. The bones of the hand may be divided into three groups, viz. *carpus*, *metacarpus*, and *phalanges*. The bones of the carpus are eight in

number, and may be divided into two groups containing four each. The first group consists of three bones, the *scaphoid*, *semi-lunar*, and *cuneiform* bones, which articulate with the radius and ulna, forming the wrist joint; and of a small additional bone on the outer side of the wrist called the *pisiform* bone. The second group consists of the remaining four bones (*trapezium*, *trapezoid*, *os magnum*, and *unciform*), which articulate with the first-named group of carpal bones on the one hand, and with the metacarpal bones on the other. The



BONES OF THE HAND.

1 Scaphoid. 2 Semi-lunar. 3 Cuneiform. 4 Pisiform.
5 Trapezium. 6 Trapezoid. 7 Os magnum. 8 Unciform.
9 Metacarpal bones. 10 Phalanges.

metacarpal bones are five in number, one for the thumb and one for each of the four digits; and in front of these are the phalanges, numbering fourteen bones in all, two for the thumb and three for each of the fingers. The bones of the hand are united to one another by ligaments. The chief movements of the hand are those of flexion and extension, and pronation and supination—pronation being the position in which the palm of the hand faces downwards, and supination that in which the back of the hand faces downwards with the palm upwards. Beneath the skin of the palm is a resistant fascia which serves to protect the underlying structures, and is known as the *palmar fascia*.

Hand Cameras are small compact varieties of cameras which are intended to be held in the hand during the taking of the photograph. They are therefore chiefly adapted for short or "instantaneous" exposures. In the majority of instruments there is no arrangement for "focussing," as a short focus lens is employed and so fixed that all objects beyond about five yards will be practically in focus. Most are adapted for taking photographs of quarter-plate size, and are supplied with arrangements by which a number of plates can be held and photographs successively taken without the necessity of opening the camera to change the

plates. Some are fitted with continuous "films" (q.v.), so that 50 or more pictures can be obtained before changing. They are therefore very useful for touring purposes, where the weight of the ordinary form is objectionable, and for photography in places where the setting up of a tripod stand, etc., would be an impossibility. The hand- or detective-camera has within recent years become extremely popular, and to meet the growing demand very large numbers of different forms exist in the market, differing chiefly only in their constructive details. [PHOTOGRAPHY.]

Handel, GEORGE FREDERICK (1685–1759), English musician, was born at Halle in Saxony on February 23rd, 1685. His real name was Georg Friedrich Händel. His father, who was a surgeon, at first discouraged his taste for music, but the boy's genius was too strong to be repressed, and, when he was seven or eight years old, his education was entrusted to Zachau, the Halle organist. At the age of nine he had already begun to compose, and could play the organ, violin, and other instruments. In or about 1696 he was sent to the court of Berlin, where his performances attracted the notice of the Elector of Brandenburg. His musical studies were continued after his father's death (1697), and in 1703 he proceeded to Hamburg, where he played second violin in the opera orchestra. His first *Passion*, produced in 1704, was followed in January, 1705, by *Almira*, his first opera. The years 1706–10 were passed in Italy, where he visited Florence, Rome, Naples, and Venice, performing everywhere with marked success, and composing *Rodrigo* (1709) and other operas. After a short stay in Hanover he came over to England in 1710, and in the following year his *Rinaldo* was produced at the Queen's theatre, Haymarket. He was recalled to his duties as *kapellmeister* at Hanover, but in 1712 he returned to England, which henceforward became his adopted home. By 1715 his services to English music had become so marked that he was granted a pension of £200, subsequently increased to £600. In 1720 the Royal Academy of Music was established at the Haymarket, and placed under Handel's management. This enterprise came to a close in 1726, but in 1729 the theatre was taken by Handel and Heidegger, and the performances were continued. The high position taken by Handel roused the jealousy of Buononcini and other Italian composers. He himself took little pains to conciliate his opponents, and a rival company was started, under the patronage of "the nobility," which, in 1734, succeeded in ousting him from the King's theatre. Subsequent ventures at Lincoln's Inn and Covent Garden both ended in failure, and Handel's financial losses so preyed on his mind that his health gave way, and even his mind was temporarily affected. His mental and physical vigour were re-established by a visit to Aix-la-Chapelle. This catastrophe marks the close of the first period of Handel's career. Henceforward he abandoned opera, and devoted himself entirely to the composition of sacred music, the field in which he was to earn lasting renown. His previous

efforts in this direction had been confined to *Esther*, an oratorio composed before 1720, and a few anthems. The year 1739 witnessed the production of *Saul* and *Israel in Egypt*. The *Messiah* was performed at Dublin in April, 1742, and soon afterwards in London. It was followed by *Samson* (1743), *Judas Macabaeus* (1746), composed in honour of the victory of Culloden, *Joshua*, and *Solomon* (1748). A large part of the wealth acquired by Handel at this period was given by him to the Foundling Hospital. In 1750 he visited the Continent, and soon afterwards composed his last oratorio, *Jephthah*. He now became almost entirely blind, but he continued his Lenten oratorio concerts, and played the organ at the performance of the *Messiah* eight days before his death, which took place on April 14, 1759. He was buried in the Poets' Corner in Westminster Abbey. Handel's outward appearance was not attractive. His manners were boorish and his temper overbearing, but this rough exterior concealed a heart full of benevolence and generous feeling. His reputation is not likely ever to suffer any diminution. It is based on his great oratorios, and especially the *Messiah* and *Israel in Egypt*, and the enthusiasm shown at the Handel Festivals bears testimony to the hold which he still exercises over the English public.

Handicap, for "hand i' cap, i.e. "hand in the cap," was the name given to an ancient method of drawing lots; but the term is now applied to games and sports when means of one kind or another are employed to place the competitors as far as possible on the same level. Thus in horse-racing a horse which has been successful in previous contests has to carry a greater weight, and in billiards the inferior player is given a certain number of points "start."

Hanensha, a historical Arabo-Berber people, province of Constantine, Algeria, Upper Mejerdia Valley, and about the head waters of the Seybouse. At present reduced to about 10,000, they were formerly very powerful, and in the 16th century the Hanensha Confederacy ruled over most of Constantine and a great part of the neighbouring territory of Tunisia. The Confederacy, which long held out against the Deyls of Algeria, was ruled by a member of the Harar family, with the title of Sheikh, whose alliance was sought far and wide and whose residence was the stronghold of Kalaa-t es-Snam, in Tunisia. Originally of pure Berber stock, they have been largely assimilated to the Arabs in speech, appearance, and religion, since the great Hilala invasion of the 11th century. Before that time most of them are said to have adopted the Jewish religion, and many were certainly Christians during the Roman sway. Since the French occupation they have been organised in the three *départements* (communes) of Hanensha, Zaruria, and Tifesh.

Hang-Chow-Foo, a Chinese town on the Tsien-tang, at the entrance of the Grand Canal, about 110 miles S.W. of Shanghai. It is the capital of the province of Cheh-chiang. Before the Mongol invasion it was the capital of the empire of

Southern China, and is described as a magnificent city by Marco Polo. It is a place of much commercial importance, and contains several splendid temples. Its silk manufactures have long been famous.

Hanging-buttress, a buttress supported on a corbel.

Hanging Gardens. The Hanging Gardens of Babylon, said to have been founded by Semiramis or Nebuchadnezzar, are minutely described by Diiodorus and Strabo. According to these authors they consisted of a series of terraces, resting on stone arches, which reached a height of 75 feet, and were arranged in the form of a square covering nearly 4 acres. They were interspersed with fountains, groves, and banqueting-halls, and the water of the Euphrates was conveyed to a reservoir at the summit by means of a screw.

Hang-nests, the American Passerine family Icteriidae, with 24 genera, containing 110 species, chiefly from the tropical parts of the continents. They are small finch-like birds, allied to the starling and weaver-bird (both which see) and most of them build penile nests, whence their popular name. [BALTIMORE ORIOLE.]

Han-kow, a town in the Chinese province of Hon-pih, situated at the point where the Han joins the Yang-tse, between 600 and 700 miles by river from Shanghai. It is closely contiguous to the towns of Han-yang and Won-chang. It suffered much in the Tae-ping Rebellion (1857), but is now gradually recovering. Metal wares and cotton goods are manufactured; there is a brisk trade in tea, metals, the cotton grown in the neighbourhood. Furs from Thibet, coal, oil, etc., and British imports are transmitted to the interior by means of junks.

Hanley, a parliamentary and municipal borough of Staffordshire, in the midst of the "Potteries," one mile N. of Stoke. China and earthenware are manufactured, and there are coal and iron mines in the neighbourhood. Pop. (1901), 61,524.

Hannibal, a famous Carthaginian general, the son of Hamilcar Barca, was born in 247 B.C. He probably took part in his father's Spanish campaigns. After Hamilcar's death (228) he carried on the war in Spain under Hasdrubal, whom he succeeded (220) as commander-in-chief of the Carthaginian forces. In the course of two campaigns he completed his predecessor's design of forming a Punic dominion in Spain as a starting point for a new attack on Rome, and then laid siege to Saguntum, a town friendly to the Romans (219), with the express design of involving them in a quarrel with Carthage. When Saguntum fell (218), the Romans despatched an embassy to Carthage, requiring Hannibal's surrender; the demand was refused, and the second Punic war began. Hannibal at once resolved to lead an army into Italy. Early in 217 he crossed the Ebro with 90,000 foot and 12,000 horse, but of this number he left behind 11,000 in the country north of the Ebro as a means of maintaining his communication with Spain, and frequent desertions induced him to send back 10,000 more

during his march from the Pyrenees to the Rhone. A Gallic force, which endeavoured to check his progress at the Rhone, was easily repelled, but the passage of the Alps, which occupied 15 days, was attended with heavy losses, owing to the difficulty of the route, the attacks of the barbarians, and the severity of the autumn weather. On arriving in Italy his army was reduced to 20,000 foot and 6,000 horse. The first encounter with the Romans took place at the river Ticinus, where the Consul P. Cornelius Scipio was completely defeated. He withdrew to Placentia, and after effecting a junction with the other consul, Ti. Sempronius, again met Hannibal on a spur of the Apennines, east of the Trebia. Here the Roman army was again routed. In the spring of 217 Hannibal continued his march southwards, and passing the consul, C. Flaminius, at Arretium, proceeded towards Perusia. Flaminius followed him, but his army was surprised at a point where the road passed between Lake Trasimene on the south, and a semicircle of hills already occupied by the Carthaginians on the north, and shut in on all sides, was almost completely destroyed. Hannibal now advanced through Umbria and Picenum to the plains of Apulia, where his movements were cautiously watched by the Dictator Q. Fabius Maximus Cunctator. Having failed to draw Fabius into a general engagement by means of a raid into Campania, he took up his winter quarters at Gereonium. In June, 216, his army of 20,000 men encountered that led by the Consuls L. Æmilius Paulus and P. Terentius Varro, which amounted to nearly 90,000, near the town of Cannae on the Aufidus. Fifty thousand Romans are said to have fallen in the battle. After this victory Hannibal was counselled by his lieutenant, Mahabarul, to advance immediately on Rome, but he deemed it more prudent to await a general rising of the Italian nations. He was joined by the greater part of South Italy, but the Latin colonies still adhered to Rome, and the Greek cities on the coast were held in check by their Roman garrisons. His admission into Capua, however, gave him a basis of operations in the neighbourhood of Rome. Here he wintered, and the luxury of the place is said to have had an enervating effect on his soldiers. From this time onwards the fortunes of Hannibal began to wane. His intrigues with the democratic party in the Greek cities led to no fruitful result, and, though he gained possession of the town of Tarentum (212), he was unable to reduce the citadel. Hoping to create a diversion in favour of Capua, now besieged by three Roman armies, he marched against Rome in 211, but the army under L. Fulvius Flaccus sufficed to ward off the attack, while the siege of Capua, continued by the other consul, terminated soon afterwards in its surrender. During the succeeding years hostilities were carried on in a desultory fashion, and with varying success, the most important event being the recovery of Tarentum by Q. Fabius in 209. But the defeat and death of Hannibal's brother Hasdrubal at the Metaurus in 207 practically ended the war. Henceforward his sole object was to maintain his position in the peninsula of Bruttium. There he remained until 203, when he was recalled to Carthage to

repel the invasion of Scipio, who defeated him near Zama in 202. After the conclusion of peace (201), Hannibal, now a Carthaginian suffete (or chief magistrate), proceeded to reorganise the government and reform the financial policy of his country, hoping that it might yet be able to renew the struggle, but the adverse party informed the Romans that he was intriguing against them, and on the appearance of a Roman embassy at Carthage he sought refuge with Antiochus, King of Syria, then about to embark on a war with his enemies (193). Antiochus rejected Hannibal's plan for carrying the war into Italy, but entrusted him with the duty of raising a Phœnician fleet, which he commanded at the battle of the Erymedon (190). When peace was concluded between Rome and Syria, Hannibal, aware that his surrender was included in the Roman terms, fled to the court of Prusias, King of Bithynia, who placed him in command of a fleet with which he defeated Eumenes, King of Pergamus. The Romans, however, sent an embassy demanding his surrender, and Hannibal took poison to avoid falling into their hands. His death is said to have taken place in 183 at Libyssa, a village on the shore of the Black Sea.

Hannington, James (1847-85), missionary bishop, was first sent to Uganda by the Church Missionary Society in 1882. After returning to England on account of his health he was consecrated Bishop of Eastern Equatorial Africa in 1884, and again set out for Uganda in July, 1885, six months after his arrival in Zanzibar. He made his way through Masai Land, but was put to death by order of Mwanga, King of Uganda, in the neighbourhood of the Nile.

Hanno, a Carthaginian navigator of unknown date (perhaps about 570 B.C.), who explored the western coast of Africa to about lat. 10° S. and founded several towns. The *Periplus*, the Greek translation of Hanno's account of the voyage, is extant.

Hanoi, or KACHAO, the chief town in the French colony of Tonquin, is situated on the Sangkoi, about 90 miles from its mouth. Silks and bullion are exported.

Hanover (Ger. *Hannover*). 1. A province in North Germany. The Elbe skirts its N.E. border, and it is bounded by the North Sea on the N., Mecklenburg and Prussian Saxony on the E., Holland on the W., and Westphalia on the S.W. The area is 14,833 square miles. The surface is level, excepting in the south, where the Hartz Mountains rise to a height of over 3,000 feet. The chief rivers are the Elbe, the Weser, and the Ems. In the north there are numerous heaths, of which that of Lüneburg is the largest; this neighbourhood abounds in sheep-walks, and bees are kept in large numbers. Cattle and horses are reared on the heaths and marshes, and on the best land, along the banks of the rivers, corn and other crops are raised. On the coast there are herring and other fisheries. The Hartz district, which is well timbered, abounds in iron, copper, silver, lead, and other mines. Platt Deutsch

or Low German is still the language of the common people, but in the upper ranks of society its place has been taken by the High German dialect.

History. In early times Hanover formed part of the duchy of Saxony, and Brunswick and Lüneburg remained in the hands of Henry the Lion after he had lost his other possessions. The modern electorate originated in 1569, when the territories of Ernst I. were divided between his two sons, the elder, Heinrich, receiving the duchy of Brunswick, the younger, Wilhelm, those of Lüneburg and Celle. This Wilhelm was the ancestor of George I. of England. The state prospered during the reigns of George I. and George II., who dealt mercifully with it in matters of taxation and endeavoured to adapt the foreign policy of England to Hanoverian interests. Hanover was on the side of Maria Theresa during the war of the Austrian Succession (1740-48), but joined Prussia during the Seven Years' War (1756-63). During the wars against the French Republic a Hanoverian contingent maintained by England was included in the army of the allies. In 1803 an army under Mortier, sent by Napoleon, terrified the Hanoverians into submission. In 1807 a part, and in 1810 the remainder of the electorate was incorporated in the new kingdom of Westphalia. At the close of the War of Liberation Hanover became a kingdom (1815), and in 1819 received a new constitution, with two representative chambers. It was revoked in 1833, but restored in 1837, when Ernest Augustus, Duke of Cumberland (1771-1851), succeeded his brother, William IV., female succession being precluded by Hanoverian law. This arbitrary ruler was compelled during the revolutionary movement in 1848 to grant a more liberal constitution. He was succeeded by his son, George V. (1849-78). Hanover aided Austria against Prussia in the war of 1866, and was annexed to the latter after its close. George V. and his son Ernest Augustus (b. 1845), refusing to renounce their claim to the throne, were forced to live outside the country. Part of their sequestered income was used for secret service purposes by the German Government. The well-known "reptile fund" of Prince Bismarck for subsidising the Press was thus kept up. In 1892, however, an arrangement was arrived at with the Duke of Cumberland, by which he recovered much of his property, but bound himself not to take any step hostile to the Emperor or the Prussian State.

2. HANOVER, the chief town of the province of Hanover (q.v.), is situated on the Leine, 112 miles S.S.W. of Hamburg. The old town, consisting of the central and western portions, is irregularly built, and many mediæval houses still line its narrow streets; the modern town has been much improved during the last 50 years, and now presents a very handsome aspect. Among the ancient buildings the most interesting are the Rathhaus (1429), the "market church" (about 1356), and the Schloss Kirche, the church attached to the Schloss or old city palace, which has an altar-piece by Lucas Cranach. The interior of the Schloss itself (1632) is elaborately decorated, and it contains many objects of artistic interest. The public buildings include the magnificent theatre, the

royal library with 170,000 vols., the Kestner Museum with valuable collections of antiquities and engravings, and the polytechnic school, which contains a large collection of mechanical implements. Hanover is now the centre of the railway system of Northern Germany, and locomotive machinery is manufactured very extensively. The other manufactures include gold and silver wares, waxcloths, sugar, chocolate, and tobacco. Brewing, distilling, printing, and bookbinding, are also important industries.

Hansa, or HANSEATIC LEAGUE, a commercial federation of the North German towns, formed in the Middle Ages. Its original aims were to facilitate the transit of goods by checking piracy at sea and the attacks of robbers on land, and to protect the interests of merchants belonging to the various confederate towns in foreign countries. But, as its power grew, it became more ambitious and sought to obtain a monopoly of trade in the Baltic and the German Ocean. The literal meaning of *hansa* is a band of men; it also denoted a tax imposed for some common object, and may have been applied to commercial leagues in either of these senses. The organisation of the Hansa appears to have originated among the German traders at Wisby on the island of Gothland (q.v.). Here there was a common treasure-house, keys of which were placed in the hands of representatives from Wisby, Lübeck, Soest, and Dortmund. From this centre the organisation spread till it included the ports on the south of the Baltic from Denmark to the Gulf of Finland and the inland towns as far south as Cologne. The Hansa first appears definitely under that title about the middle of the 13th century. The power of the Hanse towns greatly increased after their successful struggle with Waldemar, King of Denmark, resulting in the treaty of Stralsund (1370). In this war they were led by Lübeck, which henceforward figures as the chief town of the League. Bruges was the great emporium at which the products of northern and eastern Europe were exchanged for those of the west and south as well as for Eastern spices and perfumes. The men of Cologne had a house in London as early as the middle of the 12th century, but before the close of the 13th it had been absorbed in the general factory of the League, which became known as the Steelyard. In England, as in other countries, the German merchants formed an independent community; they were not subject to the law of the land, but were governed by an alderman and council of their own who enforced a rigid system of discipline. Residents were not allowed to marry, and other precautions were taken to prevent all intercourse with the English and preserve the exclusive privileges of the league intact. There were also depôts at York, Hull, Bristol, and other towns. The League continued to thrive during the 15th century, and tightened its hold on the Baltic shores. But its commercial supremacy was now threatened by the Dutch and the English, and early in the 16th century a combination of adverse circumstances hastened on its decay. Another mark of the times was the

growth of national sentiment which now displayed itself in Denmark and Sweden, very much to the League's disadvantage. The former country formed a commercial alliance with the Netherlands, and a war carried on by the League in the hope of maintaining their privileges, in which Lübeck was very ill supported by the other towns, ended in a Danish victory (1635). The want of union among the cities was partly due to the religious dissensions occasioned by the Reformation and the social strife which accompanied it. This movement injured the League in another way by greatly diminishing the demand for salt herrings and wax tapers. The discovery of a route to Archangel round the North Cape was followed by a commercial treaty between England and Russia (1555). The greater part of Livonia fell into the hands of Ivan the Terrible, and most of the remainder was seized by Sweden and Poland. The ports of the East Baltic were thus lost to the League, and the route to Novgorod was either entirely closed or became extremely difficult. The factory at Antwerp, which had taken the place of Bruges as a commercial centre, was reduced to a state of bankruptcy during the struggle between the Netherlands and Spain. The prosperity of the Steelyard outlived that of most of the other factories, but the Tudor sovereigns gradually transferred their patronage to the Merchant Adventurers, and the Hansa merchants were finally expelled by Elizabeth in 1598. The last blow was given to the League by the Thirty Years' War (1618-48). Lübeck, Hamburg, and Bremen, the only cities which remained to the League after this contest, kept on the old title till within recent years; but as their policy of free trade was opposed to the protective system of the German Empire, they have been obliged to renounce their commercial independence.

Hansard, the name of a family of printers celebrated through their connection with the Houses of Parliament. LUKE HANSARD (1752-1828), a native of Norwich, became printer to the House of Commons in 1798. The publication of the parliamentary debates was undertaken by his son, and remained in the hands of the family until 1889. "Hansard" is recognised as the standard authority on the proceedings of both Houses, and is often appealed to by peers and members of Parliament themselves. The public company entitled the Hansard Publishing Union was incorporated in 1889, but was wound up in 1892.

Hanumán, HUNOOMÁN, the Indian name of the Entellus (q.v.) and of a monkey-god, said to have assisted Vishnu (in his avatar as Rama) by raising an army of monkeys and bridging the strait between the mainland and Ceylon, by casting rocks into the sea, so as to allow Vishnu to follow his foe into the island.

Hanway, JONAS (1712-1786), an English philanthropist and traveller. Having become connected with a commercial establishment at St. Petersburg, he undertook a journey through Russia and Persia (1743-1750), of which he published an account. He afterwards settled in London, where he founded the Marine Society, the Magdalen

Charity, and other philanthropic institutions. Hanway was the first Englishman to use an umbrella, and had an animated controversy with Dr. Johnson on the subject of tea-drinking.

Hapsburg, or HABSBURG, the imperial house of, took its name from Habsburg (Hawk's Castle) in the south of Swabia. Habsburg is now a small town on the Aar, in the Swiss canton of Aargau, four miles S.W. of Brugg. The castle, the keep of which remains, was built by Werner, Bishop of Strasburg, early in the 11th century. Count Albert III. was made Landgrave of Upper Alsace by the Emperor Frederick I., and the numerous fiefs held by him and his son included the bishoprics of Strasburg, Basel, Constance, and Lausanne. Rudolf II., great-grandson of Albert III., was chosen emperor in 1273, and, after subduing Ottocar II. of Bohemia, became ruler over Austria and Styria. Subsequently the imperial crown became almost a family possession of the Habsburg line. The house is now represented through the female line by the Emperor of Austria (q.v.).

Harar, an African town in the Galla countries, about 200 miles W.S.W. of Berbera. It is surrounded by a fortified wall with five gates, and contains some stone buildings. The town carries on a trade in coffee, cattle, hides, and dye-stuffs. The district of which it is the centre, is governed by an independent emir.

Harbin, or KHARBIN, a town in Manchuria on the Siberian railway; it is the junction of the lines for Vladivostock and Port Arthur. In 1905, after the Russian defeat at Mukden in the Russo-Japanese War, the Russians under Linievitch fell back towards Harbin closely pursued by the Japanese.

Harbours are inlets of the sea protected either naturally or artificially. A harbour of refuge is simply a protected roadstead into which a vessel may pass at all times to take refuge from storms outside. The need for artificial harbours was felt in the earliest periods of marine enterprise, both for purposes of naval warfare and of commerce.

Breakwaters (q.v.) or *moles* (q.v.), suitably placed so as to resist the passage of waves coming in from the open sea, will secure a safe anchorage on their shore side. The entrance to such an anchorage, or to that of any more enclosed harbour, should be so situated that the sides shall not deflect the sea across the entrance. In both cases also it is desirable that any heavy seas that pass into the enclosure shall be allowed the opportunity of wasting themselves on a suitable beach. If the enclosure is walled all round, the incident and reflected waves round the sides may create a dangerous choppy sea in the harbour. There are advantages in having the moles arched; these certainly resist the waves to a less extent, but do not prevent the flow of currents, which when entirely obstructed may cause an immense amount of excavation from one part and deposition of silt and mud in another. It is of great importance that the harbour shall be sufficiently deep, and that it shall not be silted up in the above manner.

Various plans have been adopted to cause a scouring action of outflowing tidal water to keep the basin free from such matter; an instance of such a provision is the large sluicing basin in the Calais harbour. Quays or wharves of different kinds are added to most harbours; they require to be well protected, and are arranged to suit the situation. These and other such requisites of commercial harbours belong to the subject of docks (q.v.).

Harburg, a Prussian town, on the Elbe, five miles S.S.W. of Hamburg. The trade in oils, chemicals, artificial manures, etc., has increased since the deepening of the Elbe.

Harcourt, SIR WILLIAM GEORGE GRANVILL VENABLES VERNON (b. 1827), second son of the Rev. William Vernon Harcourt, was educated at Trinity College, Cambridge, where he graduated with honours in 1851. He practised at the Parliamentary bar, and became Queen's Counsel in 1866. In 1868 he entered Parliament as Liberal member for the city of Oxford. From 1869 to 1887 he was professor of international law at Cambridge. In 1873 he was appointed Solicitor-General, but early in the following year the Liberal Ministry resigned. In 1880 he became Home Secretary under Mr. Gladstone, but, on seeking re-election at Oxford, he was unsuccessful. He obtained a seat at Derby, however, where Mr. Plimsoll retired in his favour, and continued to represent that town up to 1895, when he was defeated, but found a seat in West Monmouthshire. He was Chancellor of the Exchequer in the short-lived Gladstonian Ministry of 1886, and again accepted the same post in 1892. On the retirement of Mr. Gladstone he became leader of the Liberal party in the Commons. In 1898, however, he resigned that position owing to the "cross-currents" within the party. He was succeeded by Sir H. Campbell-Bannerman. In 1902 he was offered a peerage, but refused it. He died in 1904.

Hardenberg, KARL AUGUST, PRINCE VON (1750-1822), Prussian statesman, was born in Lüneberg. After residing in London as Hanoverian minister, he transferred his services to Brunswick in 1781. In 1790 he was selected by the Markgraf of Anspach-Baireuth as his prime minister, on the recommendation of Frederick William of Prussia. When these provinces became a part of the latter state in 1791 Hardenberg was appointed a Prussian minister. He superintended the campaign against France in 1793-4, and brought about the treaty of Basle in 1795. In 1803 he acted as foreign minister, and succeeded Haugwitz in 1804. In 1806 he was removed from office by Napoleon's command, and became one of his most determined opponents. His efforts to maintain a steady alliance with Russia were frustrated by the Peace of Tilsit (1807), and afterwards he was banished from Prussia through Napoleon's influence, but in 1810 he returned to office as Chancellor, and proceeded to carry out his schemes for the re-organisation of Germany. He was compelled to take part in the invasion of Russia, but he afterwards formed alliances with Russia and Austria, and signed the Peace of Paris in 1814. In 1817 he

was appointed president of the Council of State. Although Hardenberg's policy was often feeble and temporising, he certainly took a leading part in laying the foundation of the Prussian dominion.

Hardening. A piece of steel is rendered extremely hard and brittle by being heated to red heat and suddenly cooled. In the process of tempering, which means the reduction of the metal to a special degree of softness, it is usual to perform the first operation of rendering the steel glass-hard, and then to raise its temperature to a certain lower temperature before cooling suddenly again. This gives it a degree of softness depending upon the temperature to which it is raised during the latter part of the process. [TEMPERING.]

Hardinge, HENRY, VISCOUNT (1785-1856), entered the army in 1798. He served in the Peninsular War, distinguishing himself at the battle of Albuera. After Napoleon's escape from Elba, he was appointed by Wellington commissioner to the Prussian headquarters, and was present with Blücher at Ligny, where he lost his left hand. He was appointed Secretary at War in 1828, and in 1834 became Chief Secretary for Ireland, a post which he again filled from 1841 to 1844. In 1844 he was made Governor-General of India. During the war with the Sikhs which ensued, he served as second in command to General Gough, the commander-in-chief in India, and was rewarded for his services with the title of Viscount and a pension from Parliament and the East India Company. In 1852 he succeeded Wellington as commander-in-chief.

Hardness. Various substances have different degrees of hardness, which do not depend simply upon their density or their chemical composition. Thus two pieces of steel may have exactly the same chemical components, but one may be rendered much harder than the other by being heated to redness and suddenly cooled. Also a piece of gold may be much heavier than a piece of steel of the same volume, and yet may be much softer. A simple method of comparing the hardness of different materials is to determine their powers of scratching others. A set of substances may be obtained in a series, each in its place being able to scratch a mark on all that succeed it, but on none that precede. These may be numbered, and any new material can be readily placed in its true position in the series by trying its scratching power successively on the substances in the set. Though there are sometimes slight differences in the hardness of different faces on the same crystal, hardness affords an easily-applied means of discriminating minerals. It is measured by reference to a scale of ten minerals, numbered in the order of increasing hardness, named after its deviser, Von Mohs, of Freiberg. Pure crystalline specimens are supposed to be taken as types, and some simple substitutes are mentioned in the following table:—

1. Talc. Can be cut with the thumb-nail.
2. Selenite or rock-salt. Can be scratched with the nail.
3. Iceland-spar or pure calcite. About the hardness of copper-wire.
4. Fluor. Can be cut with a knife.
5. Asparagus-stone or pure apatite. Can be scratched by a knife.

6. Adularia, or pure orthoclase-felspar. Can only be scratched by hard steel.
7. Rock-crystal or pure quartz. Scratches glass or a knife.
8. Topaz. Scratches a steel file.
9. Sapphire. Emery is an impure variety.
10. Diamond. Cuts glass.

Each mineral in the scale will scratch the one below it, and hardness is tested either directly with the minerals of the scale or by drawing a steel file with equal pressure over the minerals to be tested and those forming the scale. Intermediate degrees of hardness indicated as 1·5, 2·5, 3·5, etc., can be measured. The scale is an arbitrary one, the difference of hardness between 1 and 2, and between 2 and 3, being far less than that between 8 and 9 and between 9 and 10. In mineralogical works, "hardness" is often abbreviated as H.

Hardouin, JEAN (1646–1729), a learned Jesuit, notorious for his peculiar views regarding the ancient classics. He was born at Quimper in Brittany, and became librarian of the college of Louis le Grand at Paris in 1683. Hardouin held that almost all the writings attributed to classical authors were fabricated by monks in the 13th century, and that the works of art supposed to be ancient are likewise forgeries. He broached a similar theory with regard to Dante's works. He published a valuable edition of Pliny.

Hardwar, a spot on the Ganges, in the North-West Provinces, in lat. 30° N., where a large religious gathering takes place every year towards the end of March.

Hardy, THOMAS (b. 1840), novelist, was born in Dorsetshire. He studied architecture with considerable success, but abandoned it in favour of literature. The scene of his novels, of which *Far from the Madding Crowd* (1874) was the first to give him a wide reputation, is generally laid in the south-western counties. They are remarkable chiefly for their graphic delineation of rustic humour, but are rarely without an undercurrent of tragedy.

Hardy, SIR THOMAS DUFFUS (1804–78), palaeographer and antiquarian, was born in Jamaica. He entered the Record Office in the Tower of London in 1819, and in 1861 became deputy keeper. He edited *Close Rolls* (1833), *Patent Rolls* (1835), *The Chronicle of William of Malmesbury* (1840), and *Modus tenendi Parliamenti* (1846), an important contribution to constitutional history, and published a valuable *Catalogue of MSS.* (1858).

Hardy, SIR THOMAS MASTERMAN, BART., whose name is imperishably associated with that of Nelson, was born in 1769 in Somersetshire, and after seeing a considerable amount of service was made a commander in 1797 and a captain in 1798. As a commander, in the *Mutine*, he first attracted Nelson's attention, and he accompanied that hero in the pursuit of Bonaparte to Egypt. The battle of the Nile gained him his post-commission to the *Vanguard*, Nelson's flagship. Nelson took Hardy with him into the *Victory*, which he commanded at Trafalgar. After the victory Hardy took his ship to Gibraltar for a hasty refit, and then brought her home with Nelson's body on board. At Nelson's

funeral Captain Hardy bore the Banner of Emblems. He was at once created a baronet, and next served on the Halifax, Lisbon, and North American stations. During the war of 1812 he was continually engaged, and upon its conclusion was made a K.C.B. After further service as captain of a royal yacht and as commodore in South America, he attained flag-rank in 1825, and died a vice-admiral and Governor of Greenwich Hospital in 1839.

Hare, the popular name of most of the species of the family Leporidae, the chief exceptions being the Rabbit (q.v.) and the Calling Hares or Pikas (*Lagomys*), which some systematists make a distinct family. In the genus *Lepus* there are four incisor teeth in the upper jaw, though all are not readily seen, for two are rudimentary and placed just behind the functional pair. In the upper jaw there are six molars, and five in the lower jaw, on each side. The ears are long, the inner surface of the cheeks is clothed with short hair; the tail is short and upturned, the upper lip is deeply cleft; there are five digits on the fore limbs, and four on the hinder ones, and the soles are distinctly hairy. The fur is thick, and of some commercial importance, as when felted it is employed in hat-making. The Common Hare (*L. timidus*) is from 24 to 27 inches long, including the short tail, and may weigh from a dozen to twenty pounds. The coloration of the fur—a dull reddish-brown—is distinctly protective. These animals do not burrow, but generally pass the day in their "form"—a depression in the earth or grass, coming out at night to feed on green vegetation. They pair early in the year, and after thirty days the female brings forth her offspring, called "leverets," and there are generally four or five litters in a year. By the Ground Game Act (1880) occupiers of land may kill hares and rabbits found thereon. [COURISING.] This species is distributed over Europe and Western Asia, where it runs into varieties to which some writers give specific rank; it is common in Britain, but in Ireland is replaced by a variety of the smaller Alpine or northern hare (*L. variabilis*), which is also British. Besides this Irish variety, two others are known, a white form from polar, and a "blue" or greyish-brown from alpine, regions. Other species occur in Asia, Africa, and America. The Pikas or Calling Hares (*Lagomys*), of which there are from ten to twelve species, are much smaller than the true hares. They have complete clavicles, and there is one molar less on each side in the upper jaw. The type-species (*L. alpinus*), from alpine and sub-alpine Siberia, is about the size of a guinea-pig, greyish-brown above, yellowish beneath. They owe their popular name to the fact that while feeding they often utter a peculiar whistling noise.

Hare, JULIUS CHARLES (1795–1855), an early leader of the Broad Church party, was educated at the Charterhouse and Trinity College, Cambridge, of which he became a fellow in 1818. His first literary effort was a translation of Fouqué's *Sintram* (1820). In 1826 he was ordained. *Guessees at Truth* (1827), the joint work of Julius and his brother AUGUSTUS WILLIAM (1792–1834),

showed the influence of recent German thought on the teaching of Coleridge. He subsequently translated Niebuhr's *History of Rome* in conjunction with Thirlwall. He was appointed to the living of Hurstmonceux in 1832, and in 1840 became Archdeacon of Lewes. His edition of the *Essays and Tales* of John Sterling (1848), who had been his curate at Hurstmonceux, was accompanied by a life of the author, written from the point of view of an Anglican churchman. This work is now memorable only as having incited Carlyle, who had far more sympathy with Sterling's genius, to write his own graphic biography.

Harebell, or HAIRBELL, the blue-bell of Scotland (*Campanula rotundifolia*), a common wild flower of dry and sandy spots in northern regions. It has a perennial slender rhizome bearing petiolate roundish radical leaves from which it gets its name, though the more prominent caudine leaves are sub-sessile and linear. Its slightly drooping flowers on their slender hair-like stalks form a paniculate cyme; its superior calyx has five small erect sepals, and its pretty pale violet-blue bell-shaped corolla has five slightly recurved acute lobes. There are five epigynous distinct stamens with short filaments and linear anthers, and a capsule opening by pores near its base.

Hare Indians, a branch of the Athabascan family [ATHABASCANS] thinly scattered over a large part of the former Hudson Bay Territory, Dominion of Canada. The English "Hare" answers to the Franco-Canadian *Peaux-de-Lierre*, which represents the true tribal name *Kha-cho-Gottine*, that is, "Dwellers amongst the great Rabbits." They are a hunting tribe, whose range extends from the Great Bear Lake northwards along the banks of the Mackenzie, Anderson, and MacFarlane rivers to the Eskimo territory, round the shores of the Frozen Ocean—a region about 80,000 square miles in extent, with a total population scarcely exceeding 800. At present the Hare Indians find employment chiefly in the service of the Hudson Bay Company as trappers, carriers, and assistants at the stations. They are a gentle, harmless people, but indolent and somewhat quarrelsome over trifles. In physical appearance and speech they closely resemble the Chippewayans of Lake Athabasca. Many have been converted by the French missionaries. (E. Petitot, *Bulletin de la Société de Géographie*, passim.)

Hareld, either of the two species of Harelda, an Arctic genus of Ducks, in which the tail is wedge-shaped, and its two middle feathers very long.

Hare-lip, a congenital defect due to arrested development of the parts which form the upper lip. Hare-lip is usually unilateral, there being a small cleft in the upper lip a little to one side of the median line; cases of double hare-lip are occasionally met with. The only remedy for the condition is a surgical operation.

Harem (Arabic *haram*, "prohibited" or "sacred"). The portion of an Eastern household set apart for the women, into which no men, excepting

occasionally their nearest relations, are allowed to enter. The name is also applied to the women themselves. The Koran does not allow more than four wives—except in the case of the Sultan, who may have seven—but a man is permitted any number of concubines. The wives and concubines in the Sultan's harem are, like their female attendants, slaves, generally brought from Circassia or Georgia. The harem is usually under the management of the Sultan's mother, who is called "Sultana," assisted by a trusty female superintendent. The duty of keeping watch over its members is entrusted to a body of eunuchs. The inmates spend their time in spinning, sewing, and other light household labours; also in adorning their person, walking in their gardens, watching the dances of slaves, etc. The mother of the Sultan's eldest male child, whatever her previous position, is regarded as his chief wife. When he dies those who have borne him daughters only regain their freedom, but those who have borne him sons are placed in the "old scraglio." The harem is confined to the richer classes; poor Moslems have only one wife.

Hare's-ear, the popular name of the genus *Bupleurum*, which is represented in England by four rare species. They are glabrous herbs, exceptional in their order in having simple entire leaves, which in some species are perfoliate or amplexicaul, whence they were also once known as *Thoron-wax* or *Thoron-leaf*. The compound umbels of yellow flowers are surrounded by numerous leafy bracts or bracteoles.

Hargreaves, JAMES (d. 1778), the inventor of the spinning-jenny. Originally settled as a weaver at Stanhill, near Blackburn in Lancashire, he was obliged to remove to Nottingham, owing to the hostility of his fellow-workmen (1767). He afterwards took out a patent for his invention, but it was rescinded on the ground that, before obtaining it, he had sold some of his machines.

Haricot-bean, the ripe seeds of the French or kidney-bean (*Phaseolus vulgaris*), a valuable article of food much used on the Continent, especially during Lent. They contain 52 per cent. of starchy matter, 23 of albuminoids, and 14 of water, so that one pound of these beans might produce nearly 3½ oz. of the dry nitrogenous substance of muscle.

Harikari, or HARAKARI, a form of suicide formerly allowed in Japan to members of the privileged classes who were condemned to death. It consisted in ripping the body open by means of two gashes, one of which was perpendicular and the other vertical.

Hariri, ABU MOHAMMED AL KASIM BEN ALL a celebrated Arabian fabulist, was born at Basra, about the middle of the 11th century. He wrote poems and treatises on grammar, but his chief work was his *Makamat*, a series of highly humorous stories in rhymed verse, which is celebrated for the beauty of its style.

Harlech and Longmynd Beds, the lower group of the Lower Cambrian system (q.v.), grey,

purple, and red flags, sandstones and slates, with shaly beds and conglomerates, estimated at 4,000 feet thick in South Wales, on the north side of St. Bride's Bay in Pembrokeshire; at over 8,000 feet in North Wales, between Barmouth and Harlech, and in the slate district of Penrhyn and Llanberis; and at perhaps 25,000 feet in the Longmynd hills of Shropshire. The rocks of this series are in many places penetrated by igneous dykes, and exhibit distinct cleavage; but ripple-marks, sun-cracks, the impressions of rain-drops and worm-tracks (*Arenicolites*) indicate their shallow-water near-shore origin. They apparently rest unconformably upon Archæan rocks, the junction near Bangor being marked by a bed of conglomerate; but they pass conformably upward into the Menevian and Lingula Flags. Once thought unfossiliferous, they have yielded the oldest known assemblage of undoubted fossils, including a sponge (*Protospongia*), *Lingulella ferruginea*, *Discina*, and other brachiopods, the pteropod *Theca*, and *Paradoxides*, *Agnostus*, and several other genera of trilobites, besides worm-tracks.

Harlequin Duck (*Clangula histrionica*), an arctic wild-duck about a foot and a half long, which owes its popular name to its strongly-contrasted coloration of black, rufous-brown, and white.

Harley, ROBERT, Earl of Oxford and Mortimer (1661-1724), an English statesman, belonged to an old Herefordshire family. He was brought up as a Whig and a Dissenter, but soon after entering Parliament he joined the Tories. In 1701 he was chosen Speaker. Admitted to the Ministry of Marlborough and Godolphin in 1704, he became the leader of the Tory section, and made use of his cousin, Mrs. Abigail Hill (subsequently Mrs. Masham) to prejudice the queen against Marlborough, but the Whigs discovered his intrigues and he was dismissed (1708). In 1710 he was made Chancellor of the Exchequer and placed at the head of a Tory Administration with St. John as Secretary of State. He at once entered into secret negotiations with France, perhaps hoping that after peace had been secured the French would assist in effecting a restoration of the Stuarts. An attempt to stab him in the Privy Council, made by a French refugee named Guiscard (1711), increased his popularity; he was created Earl of Oxford and given the post of Lord High Treasurer. After the Treaty of Utrecht (1713) he was prevented by his vacillating character and love of intrigue from adopting the distinctly Jacobite tactics pursued by his colleague St. John (now Lord Bolingbroke), but he certainly gave some countenance to the hopes of the Pretender. In 1714 a quarrel with Bolingbroke, who had gained the support of Mrs. Masham, resulted in his dismissal. After the arrival of George I. he was impeached and imprisoned in the Tower (1715). Two years later he was brought to trial, but acquitted. The remainder of his life was passed in retirement. Harley was a man of literary tastes and a friend and patron of Swift, Pope, and other men of letters. He founded the Harleian collection of books and MSS., now in the British Museum.

Harmaline, an alkaloid of composition $C_{13}H_{14}N_9O$, which together with another, closely related to it, *harmino* $C_{19}H_{19}N_9O$, exists in the seeds of wild rue, *Peganum harmala*, and to which these seeds appear to owe their medicinal properties, being used in the East as a stimulant and narcotic.

Harmattan, a hot dry wind common on the coast of Guinea during December, January, and February. It blows seawards from the interior, and its approach is generally heralded by dense clouds of sand. It is destructive to vegetation, but tends to remove dysentery, fevers, and epidemic complaints.

Harmine. [HARMALINE.]

Harmodius and **Aristogeiton**, two Athenians who in 514 B.C. attempted to deliver the city from the rule of the Pisistratidæ, and succeeded in murdering Hipparchus, younger brother of the tyrant Hippias. Harmodius was immediately slain by the body-guard of Hippias, and Aristogeiton was afterwards seized and put to death. Four years later Hippias was expelled by the Spartans.

Harmonic. The harmonic mean between two numbers is the reciprocal of the arithmetic mean of their reciprocals. Thus if we take the numbers 4 and 12, their reciprocals are $\frac{1}{4}$ and $\frac{1}{12}$. The average of these is $\frac{1}{6}$, and the reciprocal of this average is 6. Hence 6 is the harmonic mean between 4 and 12. It may be noticed that the arithmetical mean (q.v.) between the same two numbers is 8, and their geometrical mean (q.v.) is $\sqrt[2]{4 \times 12} = 6.928$. The harmonic mean, therefore, is the smallest, the geometrical next, and the arithmetical mean the greatest. This may be proved to be always the case with any pair of numbers. [HARMONIC PROGRESSION.] Three numbers are said to be in harmonic proportion when the second is the harmonic mean between the first and third. In the applications of the above to geometry we have exactly similar definitions of lines in harmonic proportion, for their lengths are expressed by numbers. Suppose four points A, C, B, and D, to lie in the order given; then the distances A C, A B, and A D, being in harmonic proportion the points are called harmonic points and such a series possesses definite properties that distinguish it from others. The point C divides A B internally in a definite ratio; the point D will divide it externally in the same ratio. If C is close to B, the fourth harmonic D will also lie close to B, but on the farther side of it. As C gets nearer to the centre of the line A B, D recedes farther from B. When C becomes the mid-point of A B, D is at infinite distance along the line. When C is nearer A than B, its fourth harmonic will lie on the A side of the line. If O be any point on the circle described with A B as diameter, O A and O B will be at right angles to each other; this is proved by Euclid. The lines O A, O C, O B, and O D, form what is called a harmonic pencil, and the angle D O C will be found to be bisected by O B. This supplies a graphical method for finding the fourth harmonic of three points. The word harmonic has been given

on account of the applications of these principles to the theory of musical sounds.

Harmonic Motion is a periodic motion that exactly repeats itself after equal intervals. A simple harmonic motion is an oscillatory motion in a straight line from one side to another of a fixed point in the line called the *centre*. The rate of change of its speed is proportional to its distance from the centre, the special terms of the proportion settling the *period* or time taken for the moving point to perform a complete cycle in its path of motion. Its greatest distance from the centre is called the *amplitude*, variations in which will not affect the period of oscillation. The study of harmonic motions is of much importance in oscillations of all kinds, such as those of matter transmitting sound or of ether transmitting radiation.

Harmonicon is a musical instrument in which notes are produced by transverse vibrations of plates of glass on metal supported on strings one quarter of the distance from each end.

Harmonic Progression. A series of numbers are in harmonic progression when their reciprocals form an arithmetical progression. Thus we may have the A. P.— $\frac{1}{18}$, $\frac{1}{16}$, $\frac{1}{15}$, $\frac{1}{14}$. Taking their reciprocals, we get the H. P.—12, 15, 20, 30. Any three consecutive terms of such a series are in harmonic proportion. [HARMONIC.]

Harmonics, in *Acoustics*, are notes determined by vibrations whose frequencies are in the ratios of 1 : 2 : 3, etc. Given a note produced by 261 vibrations per second, its first harmonic is produced by $2 \times 261 = 522$ vibrations per second, and the second and higher harmonics have frequencies of 783, 1,044, 1,305, and so on. Using the ordinary diatonic scale the fundamental is *c*, first harmonic *c'*, second *g'*, third *d''*, fourth *e''*, fifth *g''*, and so on. In the ordinary scale of eight notes from any one, *c* to its octave the frequencies are in the ratios 1, $\frac{3}{2}$, $\frac{5}{4}$, $\frac{7}{8}$, $\frac{9}{8}$, $\frac{11}{8}$, 2. The next octave, still compared with the original *c*, would run 2, $\frac{5}{4}$, $\frac{3}{2}$, $\frac{11}{8}$, $\frac{9}{8}$, 4. And the next 4, $\frac{11}{8}$, 5, $\frac{9}{8}$, 6, $\frac{11}{8}$, $\frac{13}{8}$, 8. Those notes designated by whole numbers 2, 3, 4, 5, 6, and 8, represent different harmonics of the fundamental *c*. It will be noticed that the 7 is absent from the series; this means that the sixth harmonic is absent from the diatonic scale. That special note corresponds nearly with *b'*, but is slightly flatter. Usually when any note is sounded, harmonics may be distinguished at the same time. Experience enables the observer to pick out these up to the sixth or even higher harmonics, but there are methods by which their presence may be demonstrated separately, when collectively they cannot be distinguished. [RESONATORS.] The characters of different sounds depend on the greater or less intensity of the harmonics present. Some may die away rapidly, leaving others to produce their effects; in a violin string we hear the fundamental note and high harmonics, intermediate ones being rapidly suppressed. In a tuning-fork on a sounding-board the fundamental remains and all harmonics disappear quickly.

Remembering that different tones are due to waves of different lengths, it will readily be seen that suppression of certain waves may be effected by mechanical damping of corresponding vibrations. If a stretched violin string be touched at points half way, one-third, one-fourth, or one-fifth of the distance from one end, the notes given out by the untouched segments will be the first, second, third, or fourth harmonic of the fundamental note given by the whole string. The wave-lengths of these different harmonics are in the ratio of $\frac{1}{2} : \frac{1}{3} : \frac{1}{4} : \frac{1}{5}$, etc., and so form a harmonical progression (q.v.).

Harmonium, a musical instrument of the "free reed" class. In the harmonium the air is compressed by bellows and escapes through the reeds, whereas in the American organ—the other type of reed-organ—the bellows cause a vacuum into which the reeds admit the outside air. The reeds or "vibrators" are constructed in the following manner. Narrow rectangular slits cut in a piece of brass-plate are covered with tongues of brass, one end of which is attached to the plate, the other remaining free. The current of air which moves the reeds and thereby produces the musical tone is admitted into the wind-chest in which the reeds are placed through valves below or above the keys in the key-board. The pressure of wind arises through the action of bellows which the player controls by moving the treadles alternately with his feet, thereby pressing down the keys and opening the valves so as to allow the wind to pass from the bellows to the wind-chest. The pitch is not regulated by the force of the pressure, but by the length and elasticity of the reeds, and by the shape and capacity of the channels or air-chambers above each reed. The key-board has a compass of five octaves, from *c* to *c*. The first successful harmonium was made by Dehain, of Paris, in 1840. By the melody attachment, invented in 1864, stress is given to one or more notes in the upper part of the harmony by shutting off all the lower ones. The best harmoniums are now made in Paris. The cheapness of the instrument, and the ease with which it can be played, render it a useful substitute for the organ.

Harmony has been defined as "a proper combination of simultaneous sounds." In early times the term was used in a sense indicating melody or music, but it is now used only in the more restricted sense. It is now distinguished from Counterpoint (q.v.), and is regarded as the more elementary study; but counterpoint was systematically studied far earlier than harmony. Harmony treats of intervals, chords, discords, suspensions, passing-notes, cadences, modulations, progression, and thorough-bass. The rules of harmony have from time to time undergone considerable modification, and at present are by no means immutable; but certain broad principles have been very generally accepted. [MUSIC, COUNTERPOINT, THOROUGH-BASS, ETC.]

Harold I. (HAREFOOT), King of England
[CANUTE and HARDICANUTE.]

Harold II., King of England (d. 1066), was born probably in 1022, his father being Earl Godwine (q.v.) and his mother Gytha, a Danish lady. In Godwine's lifetime Harold was Earl of East Anglia, and on his death succeeded to the earldom of Wessex. He shared his father's banishment in 1051, and retired to Ireland, and was restored with him in 1053. During the reign of the Confessor Harold headed the English party as his father had done, and more than held his own against the Norman party. After the death of Eadward, son of Eadmund Ironside, who had been destined by Eadward the Confessor as his heir, the Earl of Wessex became the only Englishman likely to succeed him. The king, however, had promised the crown to William of Normandy, and Harold, having been ransomed by the latter when made prisoner by Count Guy, of Ponthieu (probably in 1064), promised, according to the Norman writers, to marry his daughter and secure the succession to him, receiving a part of the kingdom as a marriage portion. The whole story is obscure; and if Harold did make such a promise he repudiated it when Eadward acknowledged him on his deathbed as his heir and the Witan elected him to the kingdom.

Harold's reign was a brief and stormy one. He had immediately to repel an invasion in the north led by Harold Hardrada, of Norway (q.v.), and his own brother Tostig, whom he had alienated some years before by acquiescing in the rebellion of the Northumbrians against him and their election of Morkere as earl in his stead. No sooner were these defeated and slain at Stamford Bridge, near York, than Harold had to hurry southwards to oppose Duke William, who had landed in Sussex. The defeat and death of the last Saxon king at Hastings (q.v.) followed.

Though he had made a pilgrimage to Rome, and seen some of the French courts, Harold had not that knowledge of Continental affairs which had belonged to Godwine. He was, however, at least his equal in general ability, and his superior as a military teacher. Though certainly not devoid of personal ambition, it is likely that his efforts to conciliate the Mercian house sprang quite as much from a patriotic desire for the union of the kingdom as from the wish to secure it for himself. The best historical information regarding him is to be found in Freeman's *Norman Conquest*, which is the basis of Tennyson's play.

Harold (HARDRADA, "Stern in Council") King of Norway (d. 1066), was descended from Harold Haarfager, first King of Norway. Having been driven out of the country in his youth, he went to Russia. He then became captain of the Varangians (or bodyguards) of the Eastern Emperor, in whose service he performed exploits against the Saracens and other enemies. When compelled to leave Constantinople on account of the anger of the Empress Zoe, whose advances he had rejected, he escaped again to Russia, but returned to Norway about 1045, and soon after became king. He carried on a long war with Denmark, and in 1066 joined Tostig and the Irish in an invasion of

England. The gigantic Viking was defeated and slain with his chief followers at Stamford Bridge on September 25, 1066.

Haroun-al-Raschid (HÂRUN-ER-RASHID, "Aaron the orthodox") the fifth Abbasid Khalif (763-809), was born either in 763 or 766, and succeeded his brother Hadi in 786. He owed his throne and much of his reputation to Yahya ibn Barmek, under whom the Khalifate reached its highest point of prosperity. Harun meanwhile gave himself up to the cultivation of learning and the arts, and Bagdad became a great meeting-place of wise men, poets, and musicians. His fame extended to Western Europe, although his correspondence with Charlemagne does not rest upon good authority. In his old age Harun became jealous of the influence of the Barmecides, and caused the whole family, not excluding his especial favourite, Jaaffer, son of Yahya, to be put to death. After this rebellion broke out, and the khalif was marching to put down that of Khorassan when he died at Tus. Little is really known of Haroun's private life, and the stories of his midnight wanderings are purely mythical.

Harp, a stringed musical instrument, which has been in use from a very early period. The ancient Egyptians and the various branches of the Celtic race were especially noted for their skill as harpists. The Egyptian harps, which were sometimes seven feet high and had eighteen strings, were richly adorned with carvings and gems. The large Welsh harp was a "triple" instrument—i.e. it had three separate rows of strings. Out of the Irish harp is said to have grown the variety used in Italy and elsewhere during the Middle Ages. Compared with the perfected harp of modern times, these and other forms were but clumsy instruments, lacking in compass, sonority, and precision of pitch. The Oriental harps seldom had a pillar, and the mediæval kinds were always tuned in the same key, chromatic alterations being possible only by stopping the strings with the fingers. To remedy this defect, pedals were introduced; they first came into use in Germany early in the 18th century. Pedal harps are either "single action" or "double action"; in the latter kind, invented by Erard, of Paris, in 1810, each pedal produces two chromatic changes. The modern orchestral harp has nearly fifty strings of catgut, strung on a wooden frame, which somewhat resembles a triangle, the three sides being formed by the back, the neck, and the pillar. The frame rests on a pedestal containing the pedals, which are connected with the mechanism in the neck by pedal-rods in the pillar. The strings are attached to the neck by wrest-pins, and have their lower ends inserted in the sounding-board at the back. The pedal harp has a compass from contra F to D of the sixth octave above.

Harpoon, a pointed lance, steel-headed and usually barbed, that can be thrown or otherwise projected. To its shank a cord is generally attached. It is chiefly used in hunting large animals of the whale species. Of old, harpoons

were always flung by hand, but they are now more frequently fired from a specially-constructed gun. Some carry in their heads charges which are exploded by electricity or percussion; others have spring bars, which open out in the body of the victim, and so effectually prevent withdrawal.

Harpsichord, a musical instrument with a key-board and strings, arranged in the same way as in the piano. The sound was produced by means of pieces of leather or crow-quill, which were inserted in "jacks" connected by levers with the keys, and were pushed upwards so as to twitch the strings. The form was usually that of the grand piano, but it was sometimes square or upright; when oblong the instrument was called a spinet or virginal. The sound produced was harsh, and there was no means of regulating its force. The keyboard was from 4 to 6½ octaves in length, with one, two, three, or four strings to each key. The harp is supposed to have been invented in the 14th century. It was known in England before 1502. Bach and Handel played on this instrument, and before the close of the 18th century it was regularly employed in orchestral music, and to accompanying recitations. It has now been superseded by the pianoforte.

Harpy (from a Greek word meaning *to seize*), a creature of Greek mythology, possessing a woman's head and a bird's body.

Harpy Eagle (*Pharaohus harpyia*), the single species of a genus of Falconidae ranging from Mexico to Paraguay. The length of an adult male is a little over 3 feet; the plumage above and on the upper parts of the neck is dark slate; there are three white bands on the tail, and the belly is white. The beak and claws are large, and the head is crested. These birds feed on monkeys, sloths, young calves, and lambs, and sometimes, it is said, carry off children.

Harrari. 1. The natives of the district of Harrar, east frontier of Shoa, South Abyssinia, till lately ruled by an independent emir, but now subject to the Abyssinian emperor. They appear to have been originally Himyaritic Semites akin to the Abyssinians, and, like them, Christians of the Monophysite sect. But although they still speak a dialect of the Geez or Old Himyaritic language, they have long been fanatical Mohammedans of the Shiah sect. Nevertheless, they have preserved many Christian traditions, are nearly all monogamists, and treat their women with great respect, allowing them to go unveiled and relieving them from most of the hard work. They are distinguished by their love of letters, and have developed a certain literature, using the Arabic characters, which, however, are written in vertical lines from top to bottom instead of from right to left. A characteristic local industry is book-binding, and the Harrar earthenware and woven goods are also much prized.

2. A large Arabo-Berber nation, province of Oran, Algeria, where they occupy the elevated plateau watered by the head streams of the Shelif. There are two divisions, the Sheraga ("Eastern")

and Gharabi ("Western") Harrari, the former with fifteen, the latter with five sub-tribes; collective population, 18,000.

Harrier. (1) (The hare-dog), a small hound kept in parks in England for hare-hunting. It differs little from the foxhounds (q.v.), except in being of smaller size. (2) (The bird that harries), any bird of the Falconine genus *Circus*, with 15 species widely distributed in both hemispheres. The un-toothed bill is of moderate length, and there is a face-disk similar to, but smaller than, that of the owls. *C. cyaneus* (the Hen-harrier) and *C. aeruginosus* (the Moor Buzzard) are rare in Britain; *C. cinerascens* (Montagu's Harrier) is a occasional visitor. The males have bluish plumage on the upper surface (whence the names "blue kites" or "blue hawks"), while that of the females is brown.

Harrier Eagle, any species of *Circaetus*, with four species confined to Africa, and one (*C. gallicus*) ranging to Europe and India. These birds prey upon snakes, whence they are also called snake-eagles.

Harrington, JAMES (1611-77), a political writer of the 17th century, was born at Rand, Lincolnshire, and educated at Oxford. He afterwards visited Holland, Denmark, and Italy, staying at Rome and Venice. He took no side in the Great Rebellion, but was with the king at Holmby and in the Isle of Wight. In 1656 he published his *Oceana*, and in 1661 was sent to the Tower for advocating the carrying out of the political views contained in the book. He was afterwards removed to Plymouth, and released on account of his bad health. Harrington's life was written by Toland the Deist.

Harris. [MALMESBURY, EARL OF.]

Harris, JOEL CHANDLER (b. 1848), the author of *Uncle Remus*, was born in Georgia. He began life as a printer, but eventually became a journalist, and was in 1890 appointed editor of the *Atlanta Constitution*. His chief work, a study of negro folklore, appeared in 1880, and was followed by *Nights with Uncle Remus* (1883), *Mingo*, and other *Sketches* (1884), and other tales. He died in 1908.

Harris, THOMAS LAKE (b. 1823), the founder of a spiritualist body called the Brotherhood of the New Life, was born at Fenny Stratford, Bucks, but soon went with his father to America. He returned to England in 1858, and was there again in 1866, but finally settled in California. His brotherhood was founded on the principles of Swedenborg on its religious and of Fourier on its social side, with certain additions of his own. As head of it he exercised supreme influence, among those who submitted to it being Laurence Oliphant (q.v.). Harris's *Arcana of Christianity and Modern Spiritualism* set forth aspects of his teaching.

Harrisburg, the chief town of Pennsylvania, stands on the left bank of the Susquehanna, 106 miles N.W. of Philadelphia. Its chief buildings are the Capitol, the state arsenal, and lunatic asylum, a Roman Catholic cathedral, and about forty other churches. There is also a large state library. The

city, though beautifully situated, is a great manufacturing town, steel and iron being the chief industries, and has also a large lumber trade.

Harrison, Benjamin (b. 1833), twenty-third president of the United States, and grandson of William Henry, 9th president, was born at North Bend, Ohio. He began to practise as a lawyer at Indianapolis in 1854, and in 1860 became reporter of the Supreme Court of Indiana. He raised a regiment for the Federals during the Civil War, and served with distinction at the battles of Resaca, Peach Tree Creek, and Nashville during the year 1864. He then returned to legal practice, and was at the time an active politician on the Republican side. In 1876 he was an unsuccessful candidate for the governorship of Indiana. Three years later he actively supported Garfield's candidature for the presidency, but declined a seat in his cabinet. In 1880 he became a United States senator, but was not re-elected in 1886. In 1888 he was successful as the Republican and Protectionist candidate for the Presidency, but was defeated by his old democratic opponent, Cleveland, on seeking re-election in 1892, and retired to a professorship in California. He died in 1901.

Harrison, Frederic (b. 1831), the most prominent advocate of the doctrines of Auguste Comte in England, was born in London, and educated at King's College School and Wadham College, Oxford, of which he became fellow. He was called to the Bar in 1853, and practised in the equity courts, and as a conveyancer, at the same time giving much attention to social and literary questions. He served on the Trades Unions Commission of 1867-9, and as secretary to the Commission for the Digest of the Law (1869-70). In 1877 he was appointed by the Council of Legal Education Professor of Jurisprudence and International Law. Since 1870 he has delivered an annual address to the Positivists at Newton Hall. Many of his contributions to the reviews have been republished, and he is well known as the author of *Oliver Cromwell ("Statesmen" Series)* and *The Choice of Books*. He contested London University as a Home Ruler in 1886, but was unsuccessful.

Harrison, John (1693-1776), inventor of the marine chronometer, was the son of a Yorkshire carpenter. He received little education, and soon began to help his father. In 1726 he invented the "gridiron pendulum." His first chronometer was finished in 1735, and was tested in a voyage to Lisbon. A second was constructed four years later, a third in 1749, and a fourth in 1759. By this it was proved in a voyage to Barbadoes in 1764 that the longitude could be determined within 10 miles, but the Admiralty did not award the inventor the promised premium of £20,000 until in 1775 a fifth watch had been made. The first four are to be seen at the Greenwich Observatory. *The Principles of Mr. Harrison's Timekeeper*, with plates and preface by Maskelyne, appeared in 1767.

Harrison, Thomas (1606-60), one of Cromwell's generals and a Fifth Monarchy man, the

place of whose birth and parentage are disputed, is first heard of at the beginning of the Great Rebellion. He served under Fleetwood at Marston Moor, and was sent to report the result to the committee of both kingdoms. He was also present at Naseby and at the storming of Basing. In 1646 he entered Parliament, but subsequently took part with the army against it. He was active in bringing on the trial of Charles I., and was a member of the High Court. He distinguished himself at Worcester, and was a member of the Council of State when the Rump was dissolved. He afterwards intrigued with the Anabaptists, and was imprisoned. At the Restoration he was tried and executed as a regicide, being one of the seven excepted from the Act of Indemnity.

Harrison, William. [HOLINSHED.]

Harrison, William Henry (1773-1841), 9th President of the United States, was the son of one of the signers of the Declaration of Independence. In early life he served in the army against the Indians, and in 1801 became governor of Indiana territory. In 1811 he defeated the Indians at Tippecanoe, and next year won the victory of the Thames over the English forces. He entered Congress in 1816, became senator in 1824, and in 1828 went as minister to Columbia. In 1840 he was elected President of the United States, but died a month after his installation. His electoral campaign was the first in which mass meetings and processions were held. At the previous election he had been defeated by Van Buren.

Harrogate, a Yorkshire spa, on a hill among the moors 17 miles N. of Leeds. Its sulphureous and chalybeate springs, discovered at the end of the sixteenth century, are much resorted to for the cure of skin diseases, dyspepsia, and gout. The town was incorporated in 1884. Pop. (1901), 28,414.

Harrow, an agricultural implement, consisting of a frame with iron teeth, employed for smoothing ploughed land and covering seeds. A wooden frame was formerly used, but the whole implement is now usually made of iron. The most important varieties are the "brake," for breaking down hard soil, the "drill harrow," for pulverising between furrows of green crops, and the "chain harrow," composed of iron links, for covering seeds and eradicating weeds.

Harrow-on-the-Hill is a town in Middlesex, 12 miles W.N.W. of London. The church, which stands at the top of the hill, owes its origin to Lanfranc, and is in various Gothic styles. The school, founded by John Lyon of Preston in 1571, was originally intended for the free education of thirty poor parish scholars, but under a clause providing that some "foreigners" might be added to fill up the building the present state of things has been brought about. The fourth form school was built between 1608 and 1615, and several additions were made during the nineteenth century. In the eighteenth century and in the third decade of the nineteenth the numbers declined, but there are now more than 500 boys. They are admitted between the ages of twelve and fourteen. There

are several entrance and some valuable University scholarships. The governing body is elected by the Lord Chancellor, the Universities of Oxford, Cambridge, and London, the Royal Society, and the assistant masters. The most famous headmasters have been Archdeacon Thackeray, Dr. Sumner, Archbishop Longley, Bishop Christopher Wordsworth, Dean Vaughan, Dr. Montagu Butler, and J. E. C. Welldon. Among the *alumni* may be mentioned Byron, C. S. Calverley, Sheridan and Anthony Trollope, Lord Aberdeen, Sir Robert Peel and Palmerston, Cardinal Manning and Archbishop Trench, Lord Shaftesbury and Sir G. Trevelyan. Pop. (1901), 10,222.

Harry, BLIND, sometimes called HENRY THE MINSTREL, about whose life little or nothing is known, was the author of a poem which was long popular in Scotland. The title of the book, which was first printed in 1570, is *The Actis and Deidis of the illunder and railzeand campion, Sohir William Wallace, Knight of Ellerslie*. The author is said by Major to have earned his livelihood by going about reciting his work.

Hart, a stag (q.v.) in its sixth year.

Harte, FRANCIS BRET (b. 1839), a distinguished American writer and poet, was born at Albany in the state of New York. He received very little education, and after the death of its head the family went to California. Here Bret Harte set up a school, but afterwards became successively printer, editor, and professor of literature in the university of California. From 1864 to 1870 he was in the United States branch Mint at San Francisco, and in 1868 became editor of the *Overland Monthly*. His name first became widely known in the following year by his humorous verses, *Plain Language from Truthful James*, now commonly known as *The Heathen Chinee*. In 1871 Bret Harte settled in New York. He afterwards went to Europe, being United States consul at Crefeld in 1878-80, and at Glasgow from the latter year till 1885, after which he lived chiefly in London. He died in 1902.

Hartebeest. [BUBALINE ANTELOPE.]

Hartford, the chief town of Connecticut, United States, stands on the right bank of the Connecticut river at a distance of 50 miles from its mouth, and is about midway between Boston and New York. It was at first a Dutch fort, but in 1635 was formed into a settlement by a body of men from Massachusetts. It was incorporated in 1784, and became the capital of Connecticut in 1873. Among its finest buildings are the State Capitol of white marble, the United States Courthouse, Trinity College, and the Wadsworth Atheneum. The chief industries are the tobacco trade, the manufacture of Colt's revolvers and Gatling guns, and of hardware and stoneware. There are several asylums and a large hospital, and among religious institutions are two Romanist nunneries. Hartford was in 1814 the scene of a convention of New Englanders who were opposed to the war with Great Britain. It lasted twenty days, and advocated resistance to impressment and reforms in the United States Constitution. It was accused by the

Democrats of designing to set up a union of New England states; but although there were undoubtedly circumstances which caused a divergence of interests between the northern and southern states, there was no real wish on the part of the former to bring about a separation.

Hartington, MARQUIS OF. [See CAVENDISH.]

Hartlepool, a seaport in the county of Durham, 18 miles E.S.E. of the city of Durham. It passed from the Bruces when they became the royal family of Scotland, and was then granted to the Clifford family. From the earliest times it has been engaged in the fishing trade, and the manufacture of cement and iron ship-building are also carried on. The shipping trade has been transferred to West Hartlepool, the modern part of the town, which stands on the south of Hartlepool Bay. West Hartlepool, founded in 1847, has a fine harbour, with large docks, shipbuilding yards, and marine engine-building establishments. Coal, in large quantities, flax, grain, and timber are the chief imports; while woollen and cotton goods, cement, machinery, and other products are carried hence to St. Petersburg and the chief Baltic ports. West Hartlepool was incorporated in 1887. The Hartlepoole unite in returning a member to Parliament. Pop. (1901), 22,737.

Hartley, DAVID (1705-57), the author of *Observations on Man* (1749), was born near Halifax, and educated at Bradford and Jesus College, Cambridge, of which he became fellow. Being unable to sign the Articles, he abandoned the idea of taking orders, and became a physician, practising at Bury St. Edmunds, in London, and at Bath, where he died. His doctrine of the association of ideas has been very generally accepted; that of vibrations had less permanent value. Hartley, who was a fellow of the Royal Society, and intimate with some of the best men of his time, was engaged for no less than sixteen years upon his great work. His son, by his first wife, named DAVID (1732-1813), was a friend of Franklin and a prominent advocate of the abolition of the slave trade. He represented Hull for several years, and was the author of *Letters on the American War*. He also edited his father's *Observations*.

Hartmann, KARL ROBERT EDUARD VON, the eminent German philosopher, was born in 1842 at Berlin. He served in the Prussian army from 1858 to 1865, after which he settled in Berlin and devoted himself to philosophic studies. He made his name known in 1869, when his *Philosophy of the Unconscious (Unbewussten)* was published. This work, which reached a 10th edition in 1890, was translated into English in 1884 by Coupland. It is a combination, under the influence of the teaching of Schelling, of Hegelian idealism with the pessimism of Schopenhauer. Hartmann has also written on aesthetics, *Die Philosophie des Schönen*, etc.; on religion, *Die Religion des Geistes*, and other works; and on political and miscellaneous subjects, *Moderne Probleme*, etc. A summary of his philosophical system was produced by Koeber in 1884.

Hartshorn, SPIRITS OF, the name formerly applied to the solution of ammonia (q.v.), owing to its production, together with some of its salts, by the dry distillation of animal refuse such as bones, hoofs, horns, etc.

Hartzenbusch, JUAN EUGENIO (1806-80), a Spanish dramatist of German descent, was born at Madrid, where he became director of the national library in 1862 after many years in a subordinate capacity. His first play was written in 1836, the title being *Los Amantes de Teruel*. Among his comedies were *La Redoma Encantada* and *La Visionaria*. *Alfonso el Casto*, *La Oya y el Encogido* were the chief of his dramatic poems; he wrote also *Dona Mencia*, and several prose works, and edited the plays of Calderon, Molina, and Lopez de la Vega.

Hartz Mountains, THE, are a chain of hills running through Hanover and Saxony, between the Weser and the Elbe. They are 57 miles long, and 20 in breadth. Their average elevation is about 1,500 feet, but the Brocken is 3,740 feet high. The rocks belong chiefly to the Devonian and Lower Carboniferous formations. Silver, copper, lead, and iron, as well as marble, zinc, and other minerals, are obtained. The Hartz range forms a natural boundary between the High and Low German races, and is often mentioned in German literature.

Haruspices, in the ancient Roman religion, were soothsayers who professed to discover the will of the gods by examining the entrails of the beasts offered in sacrifice. Their prognostications were also drawn from the class of omens called "portents," such as lightning and earthquakes. They are said to have originally come from Etruria.

Harvard University, which is in the town of Cambridge, Massachusetts, and about a mile north-east of Boston, was founded in 1638. Mr. John Harvard, an English clergyman, having come to Charlestown, Massachusetts, a year before his death, left £780 and his library for the foundation of a college for the education of the English and Indian youth of the country. Only one Indian actually graduated. The endowment was supplemented by grants from Massachusetts and by contributions from the churches, and the college continued till the 19th century to be a theological seminary under state control. Since 1865 it has been governed by a board of thirty overseers elected by the *alumni*, one-sixth of the body being renewable every year. The appointment to professorships and the control of property is, however, practically in the hands of the "corporation," consisting of the president and five fellows. The number of students is upwards of 2,000, of which some 1,200 are attached to Harvard College, the Medical School having about 300 and the Law School rather less. There are 71 professors, and about 150 assistants and tutors. The total income of the university is estimated at more than £100,000 a year. The age of matriculation is usually about 18. The two main departments of study are the classical and the scientific; but a student following either of these courses has to devote a certain amount of attention to the other.

The terms amount to about forty weeks in the year. The education of women is provided for. Ladies may have access to the university library and may obtain, after a four years' course, a certificate equivalent to the Bachelor's Degree. The chief glories of Harvard are the Memorial Hall, a large building erected in honour of the *alumni* who fell in the Civil War, having a dining hall hung with portraits, where the public "exercises" are given; the Agassiz Zoological Museum, and the Peabody Ethnological and Archaeological Museum. There are also a library containing 250,000 books, a fine observatory, and a botanical garden. Harvard University is the chief seat of learning in the New World.

Harvey, SIR GEORGE (1806-76), Scotch painter, the son of a watchmaker, was born at St. Ninians. He was apprenticed to a bookseller, but at the age of twenty exhibited a picture at the Edinburgh Institution, and was made one of the original associates of the Royal Scottish Academy. In 1829 he became a full member, and in 1864, when he was knighted, became president. He excelled alike in figure-pictures and in landscapes. Of the first, the *Covenants' Preaching* (1829-30) and *Shakespeare before Sir Thomas Lucy* (1836) are well-known examples, and among his finest landscapes are *Ferragon* (1857) and *Sheepshearing* (1859).

Harvey, SIR HENRY, naval officer, was elder brother of Captain John Harvey of the *Brunswick*, and was born in 1737. Having attained post-rank in 1777, he commanded the *Ramillies*, 74, in the victory of June 1st, 1794, and was immediately afterwards promoted. In 1797 he captured the island of Trinidad from the Spaniards. He died, in 1810, an Admiral of the White.

Harvey, SIR THOMAS, naval officer, born in 1775, served in the *Ramillies* in the action of June 1st, 1794, and in the *Prince of Wales* in that of June 23rd, 1795. He was posted in 1797, and commanded the *Prince of Wales*, 98, in the attack on Porto Rico in that year, and the *Lapwing* in the expedition to Surinam. He became a rear-admiral in 1821, and died a vice-admiral, a K.C.B., and commander-in-chief on the North American station in 1841.

Harvey, JOHN, naval officer, born in 1740 at Elmton, Kent, entered the navy in 1755, and became a captain in 1777. He was for some time in chief naval command at Gibraltar during the famous siege, and in that capacity greatly distinguished himself. In 1793 he was appointed to the *Brunswick*, 74, and in her was mortally injured in the hour of victory on the Glorious First of June, 1794. A monument to his memory was erected by the nation in Westminster Abbey.

Harvey, WILLIAM (1578-1657), the discoverer of the circulation of the blood, was the eldest son of Thomas Harvey, of Folkestone. He was educated, at the King's School, Canterbury, and at Caius College, Cambridge, after leaving which he went to study at Padua, where he also took the degree of M.D. In 1609 he was made physician at St. Bartholomew's Hospital, having previously become

a fellow of the Royal College of Physicians. In 1618 he became physician extraordinary to James I., and was afterwards physician in ordinary to that king and his successor. He was present at the battle of Edgehill, and went to Oxford with Charles I., by whose favour he was appointed in 1645 warden of Merton. After the capture of the city he returned to London, where he died of gout. He was buried at Hempstead, Essex. It was in his Lumleian lectures of 1616 that Harvey first gave utterance to his thoughts on the circulation of the blood, but it was not till 1628 that his *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus* was published at Frankfort. The discovery was accepted in England but opposed by several foreign physicians. By the time of Harvey's death it was, however, generally admitted. A translation from the Latin of his complete works was published by the Sydenham Society in 1847, and a new edition appeared in 1881. Harvey was a man of great learning, being especially conversant with Aristotle. He presented a library to the College of Physicians, to whom he also left his estate of Burwash in Sussex. In 1654 he was elected president, but declined the honour on account of his advanced age.

Harwich, a seaport of Essex, situated on a neck of land on the southern shore of the estuary of the Stour and Orwell, 18 miles E.N.E. of Colchester. It is an old borough dating from the 14th century, and till 1885 returned a member to Parliament. It has a large fortified harbour, and its suburb, Parkstone Quay, is a starting-place of steamers to Antwerp and Rotterdam. Ship-building, fishing, and cement-making employ the inhabitants. Dovercourt, to the south of Harwich, is a pleasant watering-place with a sea-wall 2 miles in length. Pop. (1901), 10,019.

Hasdrubal, a name which was not uncommon among the Carthaginians. Two bearers of it are famous in history: (1) A member of the popular party at Carthage, who, having married the daughter of Hamilcar Barca, accompanied him to Spain, succeeded to his command in 229 B.C., and founded Nova Carthago (Cartagena). He was assassinated in 221 B.C. (2) The son of Hamilcar, and younger brother of Hannibal. During the first part of the Second Punic War he commanded the Carthaginian forces in Spain with varying success. In 216 B.C. he was ordered to join his brother in Italy, but was defeated by the Romans near the Ebro. In 212, however, he gained great successes over them, and, although next year the younger Scipio captured New Carthage, Hasdrubal was able to cross the Pyrenees. Early in 207 he appeared in Italy, and advanced into Umbria, but was defeated and slain at the battle of the Metaurus by the Consuls Livius and Nero. It is said that, in order to discourage Hannibal, his brother's head was thrown into his camp by the Romans.

Hase, KARL AUGUST VON (1800-90), a German theologian, was born at Steinbach in Saxony. He was expelled from Erlangen University on

account of his connection with the "Burschenschaften," a political union of students, and was afterwards imprisoned for ten months at Hohenasperg for similar reasons. In 1830 he became professor of theology at Jena, and there passed the rest of his life. In 1883 he was ennobled for his services to Protestant theology. His most popular works were *Lehrbuch der Evangelischen Dogmatik* (6th ed., 1870); *Hutterus Redivivus* (12th ed., 1883); a *Life of Jesus* and a *Church History*, of which an 11th edition appeared in 1886. He also left an autobiography down to 1830, under the title *Ideale und Irrthümer*, and an unfinished Church history.

Hashem, the name of several Algerian tribes, now mostly Arabised, but originally a branch of the historical Zenata Berbers, whose chief stronghold was the famous city of Flement in the province of Oran. Abd-el-Kadir, the valiant Algerian chief who held out for so many years against the French, was a member of the Hashem tribe settled in the district of Mascara, south-west of the city of Oran. Since the French conquest the Hashem nation has lost all political cohesion, and is now dispersed in small fragments over the whole of Algeria with a collective population of less than 20,000.

Haslar Hospital. The Royal Naval Hospital at Haslar, near Gosport, was begun in 1716 and completed in 1762. It is a regular brick building of four storeys, standing in grounds of 33 acres. The main front is 567 ft. long, and the building contains 114 wards, most of which have a uniform length and breadth of 60 ft. by 24 ft. Forming part of the establishment are governor's and surgeons' quarters, a chapel, and a cemetery, etc.

Hassasna, the name of four Berber tribes, province of Oran, Algeria. The first occupy the arid steppe east of Sidi bel-Abbes on the route to Mascara; the second inhabit the Mahafi district west of Relizane; the third are seated on the elevated plateau in the basin of the Shott-esh-Shergui, south-east of Saidia; the fourth lie farther west in the Shott-el-Gharbi district; total population, about 10,000.

Hassein, the name of several Algerian tribes, the most powerful of whom are those of the Great Kabyle uplands in the province of Constantine. All are originally Berbers, and many still speak dialects of the primitive Berber language, while others are now of Arabic speech.

Hastings, a seaport in Sussex, lying between two hills, 62 miles south of London by the nearest railway route, and 33 miles east of Brighton. The name is said to be derived from a Danish rover. In the Bayeux Tapestry it is called Hestinga-caestra. The site of the original town is now covered by the sea. William the Conqueror erected a fort on the western hill, where the castle was afterwards built, and made it one of the Cinque ports. In 1377 the town was burnt by the French. It received its charter in the first year of Elizabeth, and this was enlarged by Charles II. From 1370 till the last Reform Bill Hastings returned two members to

Parliament, but now sends one. On the western hill there are the ruins of the old castle consisting of two towers, and in 1824 a Norman chapel was excavated. The principal old churches are those of All Saints and St. Clement's, in the Perpendicular style. There are also a Roman Catholic college and Augustinian monastery. The town hall was built in 1823, and the Albert Memorial in 1864. The Alexandra Park, 70 acres in extent, was opened in 1882. Some little way beyond the West Hill lies St. Leonards, the more modern and fashionable part of the united borough. Hastings Pier is 900 feet long. At St. Leonards a new pier was opened in 1891. Besides the long line of open parades, there is the Marina, a covered-in parade 600 feet long. Hotels are numerous, and every convenience and luxury tempts the visitor. The coast and inland scenery towards the east are picturesque in the homely English style. Fishing and boat-building employ a large section of the inhabitants, but provision for the wants of invalids and other visitors affords an occupation to a still larger number. Pop. (1901), 65,528.

Hastings, FRANCIS RAWDON-HASTINGS, MARQUIS OF (1754-1826), one of the ablest of the Governor-Generals of India, was the eldest son of the first Earl of Moira. He left Oxford without taking a degree, and in 1773 went to America as a lieutenant in the army. He served with distinction throughout the war, and in 1778 was made adjutant-general in America. He commanded the left at the battle of Camden (August 16, 1780), and on April 25, 1781, won the battle of Hobkirk's Hill. Soon after this he sailed for England, and was captured on the way by a French cruiser, but speedily exchanged. He entered the Irish Parliament, and in 1783 was created an English peer. At first he acted with Pitt, but afterwards joined the Opposition, and as Lord Moira became the intimate friend of the Regent. He served under the Duke of York in Belgium, and in 1797 was talked of as head of a Whig Ministry. He strongly opposed the Irish Union in both Parliaments. After being some time commander of the forces in Scotland, he joined the "Ministry of All the Talents" as Master of the Ordnance. After the death of Perceval he was again destined for office, but soon after Lord Liverpool became Premier Lord Moira went to India as Governor of Bengal. Here he remained from 1813 to 1823. His term of office was marked by the subjection of the Goorkha state of Nepaul, for the conduct of which he, in 1816, was made a Marquis; by the defeat of the Pindharees and Mahrattas in 1817-18; by the purchase of Singapore (1819); and by the ability with which financial and administrative questions were treated. Notwithstanding all this, and the considerable additions he had made to their territory, he was accused by the East India Company of being interested in a banking firm which had made a loan to the Nizam, and in consequence of the feeling which was displayed he resigned in 1821. In 1824 he was made Governor of Malta, and died on board ship in Baiae Bay two years later. His family had no connection with that of Warren

Hastings, whose career was in some respects so much like his own.

Hastings, WARREN (1732-1818), was born at Churchill in Oxfordshire. The expense of his education at Westminster was borne by his uncle. When the latter died, the boy's guardian sent him to India as a writer. In 1755 he became a member of the Council at Kasim Basar, and he was imprisoned at Murshidabad when, in 1756, the Nawab of Bengal took Calcutta. After its recapture he was sent by Clive as resident to Murshidabad, where he first came into conflict with Nand Kumar (Nuncomar). In 1761 he was summoned to Calcutta, and was soon after sent by Vansittart to Patna to settle commercial disputes. The first period of Warren Hastings's career was closed when, in December, 1764, he returned to England. In 1769 he was sent out as second councillor at Madras, and two years and a half later was appointed Governor of Bengal. He immediately set about reforming the finances by putting the collection of revenue in the hands of natives under English supervision, and in reorganising the judicial system. At this time, in accordance with the "Regulating Act" (1773), Hastings was appointed Governor-General, but could act only with the advice of his council of five. Of these all except one, Barwell, united to oppose his views. Nand Kumar, an Indian official, supported them by charging Hastings with corruption. Hastings in return charged him with conspiracy. Meanwhile Nand Kumar was tried before Chief Justice Sir Elijah Impey on a charge of forgery brought by private individuals, and condemned by him to be hanged. Macaulay charged Hastings with a judicial murder in this matter, but Sir James Stephen and others have shown that there is little or no case against him. The Governor-General had sent in a conditional resignation when charged with corruption, but when he heard of its acceptance he refused to submit, especially as all of his opponents, except Francis, were now dead. At this time, in August, 1780, the quarrel between Hastings and Francis came to a head, and a duel was fought at Alipore, after which Francis returned, severely wounded, to England. In 1781 occurred "the robbery of the Oudh Begums," of which so much was made in the trial of the Governor-General. Early in 1785 Hastings resigned the governorship and sailed for England. He had long retained with difficulty his position, the Court of Directors being dissatisfied with the smallness of the revenue returns. Francis had for some time been fanning an agitation against him, and Burke eagerly took up the matter. An impeachment for extortion and illegal measures was carried by a large majority, and Burke, Sheridan, and Fox as managers delivered highly eloquent orations. However, after a trial, which occupied 145 days and extended over more than seven years, Hastings was acquitted. Although ruined by the expense, he was saved from insolvency by a grant from the Court of Directors. In 1814 he became a Privy Councillor, and in his old age received many other honours. He refused a

peerage unless coupled with a public reparation, which was denied him. Judged by the standard of his own times, he is now shown to have been in personal integrity far superior, and in other respects at least morally equal to his contemporaries.

Hastings Sand, a series of fresh-water sands, with subordinate beds of clay, shale, lignite and calcareous sandstone, in all nearly 1,000 feet thick, forming the lower part of the Wealden series of the Lower Cretaceous. They are named from their development in the cliffs at Hastings, Sussex. Near Battle and in the Isle of Purbeck they can be traced conformably downwards into the Purbeck series and elsewhere, though rarely, conformably upwards into the Weald clay. The series is subdivided as follows :—

Tunbridge Wells Sand { Upper Tunbridge Wells Sand with Cuckfield Clay.
Grinstead Clay.
Lower Tunbridge Wells Sand.

Wadhurst Clay.
Ashdown Sand, with Fairlight Clays at its base.

The sands are often false-bedded, the clays occur at varying horizons, and clay-ironstone and limonite in the Wadhurst Clay was the chief source of the iron of the Sussex iron-works which flourished in the 16th and 17th centuries. A calcareous sandstone, known (from Tilgate Forest near Cuckfield) as Tilgate Stone, occurs at several horizons and is rich in reptilian remains, including crocodiles, *Iguanodon*, *Hylaeosaurus*, and other dinosaurs. These animals were discovered by Dr. Mantell in the Cuckfield district. Some hard beds in the Tunbridge Wells Sand form the remarkable Toad-rock and the High Rocks near Tunbridge Wells. Beds containing small species of *Cyrena*, a freshwater bivalve, are not infrequent, and fossil-ferns, horse-tails, cycads and conifers also occur.

Hatch, EDWIN (1835-89), a liberal theologian, was born at Derby, his father being a Nonconformist. He was educated at King Edward's School, Birmingham, and Pembroke College, Oxford. He took orders in the English Church, and after some parochial experience in East London, was for three years (1859-62) professor of classics at Toronto, and for four years rector of the Quebec High School. In 1867 he returned to England, and was Vice-Principal of St. Mary Hall, Oxford, from that date till 1885. In 1880 he was Bampton Lecturer, and from 1882 to 1884 Grinfield Lecturer on the Septuagint. In 1884 he was also appointed Reader in Ecclesiastical History. His *Organisation of the Early Christian Churches* (Bampton Lectures) was translated by Harnack. Among his other works were *The Growth of Church Institutions* (1887), and *Essays in Biblical Greek* (Grinfield Lectures), (1889), and he had begun a *Concordance to the Septuagint*.

Hatfield, a market-town in Hertfordshire 18 miles N.N.W. of London. It was formerly the property of the Bishops of Ely, and is hence sometimes called Bishops Hatfield; but the palace and manor were seized by Henry VIII., and the former became a royal residence. Hatfield House was built in 1611 by Sir Robert Cecil, afterwards

Earl of Salisbury, and still continues to be the property of his descendants. Pop. (1901), 7,551.

Hathras, a town in the North-West Provinces of India, 21 miles S. of Oligarh. Sugar, cotton, grain, and oil-seeds are exported in large quantities, and the town is celebrated for its carved work.

Hatto, the name of two Archbishops of Mainz. The second, and more famous, when Abbot of St. Boniface, was sent by Otho I., Holy Roman Emperor, as his ambassador to the Pope in 961, and was afterwards, as Archbishop of Mainz, one of his chief councillors. His subsequent career is legendary. Tradition said that he was punished for his oppressions by being devoured by rats in the Mausethurm, near Bingen, on the Rhine. He died about 970.

Hatton, JOHN LIPSTROT (1809-86), a popular musical composer, was born in Liverpool of a musical family. He played a part in *Othello* at Drury Lane in 1832, and it was as chorus conductor in this theatre in 1842-43 that he first became known. He was afterwards employed as conductor of the Glee and Madrigal Union, conductor for Charles Kean at the Princess's, and of the Ballad Concerts at St. James's Hall during their first nine seasons. Among his best-known works are the cantata, *Robin Hood*, *When Evening's Twilight*, a part-song, and, among his numerous songs, *To Anthea*, and *Simon the Cellarer*.

Hauff, WILHELM (1802-27), a German writer of some performance and great promise, was born at Stuttgart and educated at Tübingen. He was for a short time a private tutor, and had edited a paper for some months when he died so prematurely. He is chiefly remembered by his *Märchen* and others of his tales, such as *Das Bild des Kaisers*, and *Die Betterin vom Pont des Arts*. He also wrote *Phantasien im Bremen Rathskeller*, a few satires and poems, and *Lichtenstein*, a once popular romance. An 18th edition of his complete works appeared in 1882.

Haulbowline, a royal dockyard situated on an island in the Cove of Cork, opposite Queenstown. It includes a fine dock 425 feet by 94 feet, and a basin entrance 720 feet by 94 feet, with a basin 530 feet wide and 2,110 feet of quayage.

Hausa (HAUSSA, HOUSSA), one of the great nations of Central Soudan, whose domain extends from the west frontier of Bornu westwards to the Niger, and from the Benue river northwards to the Sahara. Here are situated the so-called *Hausa Bokoi* ("Seven Hausas"), that is, the seven original Hausa states, which were overthrown at the beginning of the nineteenth century by the Fulah conqueror, Othman dan Fodio, and which now form part of the Fulah empire of Sokoto. [FULAHS.] But the Hausas have preserved their nationality intact, and are gradually absorbing their Fulah rulers. Thanks to their intelligence and commercial spirit their language has become the chief medium of intercourse from Lake Chad to the Gulf of Guinea, and the Hausas appear destined to

become the dominant people throughout Central and West Soudan. They are Mohammedans of a mild type, thus holding an intermediate position between the fanatical Fulahs and the pagan Negro populations. The national traditions, physical type and language show that they are not full-blood Negroes, but a Negroid race profoundly modified by long contact with the Hamitic Berbers and Tibus of the Sahara. The hair is woolly, and the skin dark, but the features are mostly regular, with a cheerful, pleasant expression contrasting favourably with the somewhat brutal appearance of their Kanuri (Bornu) neighbours. Their soft melodious language differs greatly from the Kanuri, and shows certain Berber and Tibu affinities, confirming the general impression of their mixed descent from the Soudanese and Saharan populations. The national name *Hausa* appears to be of recent origin, being unknown to Leo Africanus or any other writers earlier than the 16th century. It is probably connected with the term *Ausa* applied by the Berbers to the region east of the Niger in opposition to *Gurma*, the region west of that river. But there are two forms, *Hausana* and *Ba-Hauché*, the prefix of the latter being identical with the collective prefix *ba* of the Bantu peoples in the southern half of the continent. As enterprising traders and skilful craftsmen the Hausas have acquired a marked superiority over all the surrounding populations, a superiority which is independent of political fluctuations, and which has survived their own political ascendancy. They have always been friendly to the English, and most of the native troops in the service of the Crown and of the British chartered companies are raised in the Hausa states. They were of much service in the Ashantee war. In 1892 an association was formed in London for the study of the Hausa language, which is spoken with remarkable uniformity by probably not less than 20,000,000 natives of Central and West Soudan (Denham and Clapperton, *Travels and Discoveries*, 1826; Barth, *Travels*, 1857; Baikie, *Observations on the Hausa and Fulfulde Languages*, 1860; Rev. F. Schoen, *Grammar* (1862), and *Dictionary* (1877) of the *Hausa Language*.)

Hauser, KASPAR, a young German whose strange history excited a good deal of attention in the second quarter of the 19th century. In May, 1828, he appeared in Nuremberg dressed like a young peasant, with a letter to an officer in the town. According to his story, he had passed his life sitting in a cage, and had been fed on bread and water by a man who also taught him how to write. This man had at length clothed him and brought him to Nuremberg, and had then disappeared. Fifteen months later he received a wound on his forehead which he attributed to the same person, of whom, however, no trace could be found. Hauser now became one of the sights of the town, and, having been visited by Lord Stanhope, was adopted by that nobleman and sent to Ansbach to be educated. He at first made great progress, but soon began to deteriorate both mentally and morally, until in December, 1833, he was

again wounded, this time in the side, but, as he said, by the same man. Three days after he died, and the mystery remained unsolved. It appears probable that he was either the victim of a ruthless parent or enemy, or else was a madman. Some believed him to be heir to the throne of Baden, but the government produced in 1875 documentary evidence in disproof of the assertion.

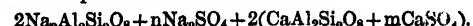
Hausmannite, a dark brown mineral consisting of an oxide of manganese, represented by the formula Mn_3O_4 , which occurs crystallised in quadratic pyramids, chiefly at Thuringia and the Hartz mountains. It has a specific gravity of 4.8, and crystals may be artificially prepared by heating the powdered oxide in a stream of hydrochloric acid gas, HCl . By cold sulphuric acid a mixture of *manganous* and *manganio* sulphates is obtained, while if warmed with hydrochloric acid chlorine is liberated—



Haussmann, GEORGE EUGENE, BARON (b. 1809), was born in Paris, and having entered the service of the state rose to be Prefect of the Seine in 1853, and held the position till 1870, when he was dismissed. He was very energetic in carrying out public works, and was rewarded for his service by Napoleon III., who made him a senator and ennobled him. His improvements, however, not only involved much destruction of historic buildings, but were undertaken with an entire disregard of economy. He was for some time a director of the Crédit Mobilier, and in 1881 was elected to the Chamber of Deputies. He died in 1891.

Haüy, RENÉ JUST (1743-1822), an eminent French mineralogist, was born of poor parents at St. Just, Oise, in 1743. Sent by friends to the College of Navarre, Paris, he at first devoted himself to botany, but afterwards to crystallography, the pyro-electric properties of minerals and general mineralogy. He discovered the geometrical laws of cleavage in crystals (q.v.) and the connection between pyro-electricity and hemihedrism. He was a canon of Notre Dame, and became professor of mineralogy at the Museum of Natural History. He died in 1822.

Hauyne, named after the mineralogist Haüy (q.v.), is a silicate of sodium and calcium combined with sulphates of the same metals:



It crystallises in the Cubic system, and is generally bright blue or greenish-blue, but sometimes reddish or greyish. The crystals usually contain fluid-cavities, gas-bubbles and microliths. They occur in such volcanic rocks as the phonolites, associated with nepheline and leucite.

Havana (SAN CRISTOBAL DE LA HABANA), the capital of Cuba, is on the north-western coast of the island. It was founded by Diego Velasques in 1515, but originally stood four miles off on the opposite shore. It has suffered much at the hands of buccaneers, but after the seventeenth century, when it had become the centre of the Spanish West Indian trade, became more secure. It was

captured by the English in 1762, but redeemed at the peace. The modern part of the town lying to the west is well built, but the older part is made up in narrow and dirty streets. The cathedral, built of 1724, contains the bones of Columbus. Among the institutions are a hospital, which includes orphan and lunatic asylums and a poorhouse, and is called "Beneficencia;" a university, an arsenal, cadet and technical schools, and several theatres. Havana has a magnificent harbour defended by fortifications, and exports immense quantities of cigars and sugar, besides molasses, rum, and honey. The chief export trade is with the United States. Rice, flour, cod-fish, coal, are the chief imports. The place used to be known as "The Havannahs."

Havel, a navigable tributary of the Elbe, rises in a small lake in Mecklenburg, and flows in a southerly direction as far as Potsdam, where it turns west, and ultimately taking a northerly direction joins the Elbe a few miles south of Wittenberg. It has a total course of 220 miles.

Havelock, Sir HENRY (1795-1857), a gallant British officer, was the son of a Sunderland ship-builder. He was at the Charterhouse with Grote, Connop Thirlwall, and Julius Hare. He obtained in 1815 a commission in the 95th foot. In 1822 he exchanged into the 13th, in order to go to India, and a year after his arrival was appointed deputy-assistant-adjutant general to the army in Burmah. He published an account of the first Afghan War as he had done of the Burmese expedition. He was appointed Persian interpreter by Elphinstone, and accompanied Sir Robert Sale in the following campaign. He was next named deputy-adjutant-general by Pollock, and was made C.B. in 1842 for his services throughout the war. In the first Sikh War he was present at Mudki (where he had two horses shot under him), and also at Ferozeshah and Sobraon. In 1849 he went to England on sick leave, and returned two years later. In 1854 he was named quarter-master-general in India, and shortly after adjutant-general. He commanded a division under Outram in the Persian War. On the outbreak of the Mutiny he was sent to Allahabad in command of a division. From this city he set out to relieve Cawnpore, which he accomplished after defeating the Sepoys at Futtehpore and Aong. He had marched 126 miles in the height of summer, and won four victories on the way. After providing for the health of the troops he next advanced to relieve Lucknow. On July 29 he won a victory at Onao, and on the same day stormed Busseerutunge. He was compelled, however, to fall back, owing to the bad health of his troops and the want of ammunition, and to secure his retreat had to fight another battle. He was now superseded by Outram, who, however, determined to serve under him until the work of relieving Lucknow had been carried out. On arriving there on September 26th after much hard fighting, they could only reinforce the garrison, but were soon relieved by Sir Colin Campbell. Havelock was created K.C.B., but died on November 20th.

Havre (LE HAVRE DE NOTRE DAME DE GRACE), a French port situated in the department

of Seine-Inférieure, on the northern bank of the estuary of the Seine. It is 143 miles by railway from Paris. It owes its rise as the second commercial port in France to Francis I., who built and fortified the harbour. It was held by the troops of Elizabeth in 1562, and it was several times bombarded by the English in the wars of the succeeding centuries. The harbour is a very fine one, but is difficult of approach on account of the sandbanks lying off it. To meet this a plan was brought forward in 1889 for an outer harbour with a new entrance from deep water. Many emigrants sail annually from this port. Woollen and cotton goods, potatoes, eggs, silks, and butter, are among the chief exports, and wine and millinery in large quantities are sent out from it. The harbour dues are heavy. Ship-building is largely carried on, and there are also cannon-foundries, flour-mills, machine-factories, and dye-works. Among the chief buildings are the church of Notre Dame (16th century), a town-hall in the Renaissance style, and a museum. It has an important chamber of commerce, and hydrographical and commercial schools. Neither the sanitary nor the railway arrangements are very satisfactory; but it is much resorted to for sea-bathing.

Hawaii, or OWHYHEE, and eleven other islands (called the SANDWICH ISLANDS) constitute the state of Hawaii. They are situated in the Pacific Ocean, between lat. 19° and 22° N., and long. 155° and 160° W. The chief of the group are Hawaii the largest and most southerly; Maui, Lanai, and Kahului, Molokai, Oahu, Kauai, and Niobau. The Sandwich Islands are said to have been discovered in 1542, but their first real connection with history dates from 1778, when Captain Cook came upon them in his voyage round the world. It was in Kealakekua Bay, on the western coast of Hawaii that he was murdered in the very next year. The islands became one kingdom under Kamehameha I. at the end of the 18th century. Under the reign of his successor idolatry was abolished, and missionaries began to teach the people. Kamehameha II. and his queen died in England in 1824. In 1840 the next ruler granted a constitution, and three years later the independence of Hawaii was guaranteed by England and France. The death of its fifth king in 1873 brought to an end the Kamehameha dynasty. Lunalilo became king but was succeeded next year by Kalakaua, who in 1887 granted a fresh constitution. In January 1891, Liliuokalani became queen, but was dethroned two years later by a revolution. In 1898 they were annexed by the United States.

The total area of the islands is about that of Wales, Hawaii itself being 4,210 square miles.

The island of Hawaii is very mountainous, and contains two active volcanoes, Mauna Kea and Mauna Loa, each over 13,000 feet in height. It is also in Kilauea, the largest active volcano in the world; and in Maui is Holeakola with the largest crater, nearly 30 miles in circumference and 3,000 feet in depth. The climate, considering the tropical situation of the archipelago, is temperate, the soil is generally poor, but in the beautiful

valleys are fertile tracts. Sugar and rice are grown, and on the Waimea plains in Hawaii large flocks of merino sheep find pasture. There is abundance of tropical fruits, and breeds of half-wild horses and dogs are among the animals. There are no minerals. Coral and rock and basalt are used for building purposes. None of the rivers are navigable, and there is very little rain except on the north-east coasts. Commercially, the Hawaiian islands, lying in the route between America, China, and Australia, are important. The greater part of the trade is the hands of the Americans, and in 1876 a reciprocity treaty was made with the United States. Manufactured goods are largely imported, and the chief exports are sugar, coffee, rice, and hides. Honolulu (by Oahu) has the only commodious harbour, but the roads are generally good, and telegraphs and railways are in use in the larger islands. Honolulu is lighted by electricity, and telephone communication has been established there. American coinage is in use. The expenditure exceeds the revenue, and the public debt is largely in English hands.

The natives are the northernmost branch of the large brown Polynesian race, and appear to have at some remote period reached the Sandwich Archipelago through the Marquesas group from Samoa. Hawaii is a dialectic form of Havaiki, which in the Marquesas is "the land of their forefathers," and which is a variant of Savali, originally Savaiki, still the name of the chief island in the Samoan Archipelago. Like nearly all the East Polynesians, the Hawaiians are rapidly dying out, having diminished from about 200,000 at the time of Captain Cook's discovery (1778) to 29,789 in 1900. They are subject to the so-called mai-paké, a species of leprosy, all the victims of which are confined to a secluded valley in the island of Molokai, which seems destined ere long to become the grave of the race. They are being replaced by immigrants, chiefly from the Azores, China, and Japan, all of whom increase as steadily as the aborigines decay. The Hawaiians are all Christians, mostly Protestants, speaking or understanding English as well as their primitive Polynesian dialect, which is closely related to that of the Marquesas group. (Miss Bird, *The Hawaiian Archipelago*, 1878; Fernander, *Origin of the Polynesian Races*, 1885; Whitney, *Hawaiian Guide Book*, 1890.)

Hawāra, a historical Berber people, who at the time of the first Arab invasion (7th century) were spread over a great part of Mauritania, but are now represented only by the Hawāras of the Jebel Hawāra and other mountains about the head waters of the Shelif. Their power was completely broken by the Arabs, and the nation scattered in fragments all over North Africa as far as Upper Egypt and the Western Sahara, where the name still survives in the local geographical nomenclature.

Hawfinch (*Coccothraustes vulgaris*), a British finch, widely distributed in Europe and temperate Asia, and sometimes called the Common Grosbeak. The adult male is about six inches long; the plumage above is of various shades of brown, with a broad band of grey on the neck; the wings are

black, with the greater coverts white, and the under surface is vinous red.

Hawick, a town in Roxburghshire, Scotland, 52 miles S.S.E. of Edinburgh. The only traces of its antiquity are the Moat and a part of the Tower hotel, which was once a residence of the Douglases of Drumlanrig, one of whom granted the town a charter, which was renewed by Queen Mary in 1545 and reformed by Act of Parliament in 1861. Hawick was burned by Lord Sussex when he invaded Scotland in 1570. The present buildings are all extremely modern, though a church which was rebuilt in 1763 dates back to the 13th century. The hosiery manufacture, begun in 1771, and the making of plaids and tweeds, set on foot about 1830, are the chief industries. Hawick unites with Selkirk and Galashiels to return one member of Parliament.

Hawk, a loose name for any raptorial bird that does not prey upon carrion, thus excluding the owls and vultures. It is properly confined to the Accipitrine genera, *Accipiter* [SPARROW-HAWK] and *Astur* [GOSHAWK], in which the bill bears no tooth.

Hawke, EDWARD HAWKE, first Lord Hawke, one of the greatest of English naval commanders, was born in 1705. He rose to the rank of commander in 1733, and to that of captain in the following year, and in 1747 became a rear-admiral. He was at once given command of a squadron which on October 14th, off Finisterre, met and crushingly defeated a French squadron. For this service he was made a K.B. In 1755 he took command in the Channel, but after the recall of Byng was transferred to the Mediterranean. In 1757, in which year he became an admiral, he was given command of the expedition to Rochefort, an expedition which failed owing to the military commander's lack of decision. Hawke, having brought the expedition home again, returned to blockade the French ports, and was able to effectually frustrate the dispatch of a squadron for the reinforcement of Louisbourg. In 1759 he won at Belleisle one of the most brilliant victories in the annals of history. Hawke on his return was awarded a pension of £2,000 a year. In 1762 he was made Rear-Admiral of England, in 1764 Vice-Admiral of England and First Lord of the Admiralty, and in 1768 Admiral of the Fleet, and in 1776 he was raised to the peerage. In 1781, after a career of extraordinary usefulness and honour, he died. He ranks with Nelson and Blake among the very first of British naval heroes.

Hawk-eagle, any bird of the genus *Spizaëtus*, with ten species from tropical and sub-tropical regions of both hemispheres. There is generally a well-developed crest.

Hawke Bay, a province in the northern island of New Zealand, on the eastern coast between Auckland and Wellington. The area is 4,410 square miles, and the population in 1906 was 42,242. It takes its name from Sir Edward Hawke (q.v.), who was at the head of the Admiralty when Cook

discovered it. There is much forest, but much farming also. Napier, a port, is the chief town.

Hawker, ROBERT STEPHEN (1803-75), a Cornish clergyman and poet, was the son of a Plymouth physician and grandson of a well-known vicar of that town. He was educated at Cheltenham and Pembroke College, Oxford, and before he went up married a rich lady. He won the Newdigate prize in 1827. Having been ordained in 1831, he was presented three years later to the vicarage of Morwenstow, on the north coast of Cornwall, where he passed the rest of his life. He married as his second wife a Polish lady, by whom he is thought to have been persuaded to enter the Roman Church. Of his poems, the best known, is the ballad *And Shall Trelawney Die?* which Macaulay quoted as a genuine work of the 17th century. His *Records of the Western Shore*, published in 1832, reappeared in 1840, with additions, in *Ecclesia*; and further additions were contained in *Echoes of Old Cornwall* (1846). *The Quest of the Sangreal* was published seven years before Tennyson's *Holy Grail*. In *Cornish Ballads* (1869) many of Hawker's early poems were reprinted. Biographies by Mr. Baring-Gould and the Rev. F. G. Lee have been published, and Hawker's friend, J. Godwin, edited his complete works in 1879.

Hawkers. Hawkers and pedlars are persons who carry their goods from place to place for inspection and sale. A licence duty is imposed upon them by the statute 50 Geo. III. c. 41, which also contains various provisions affecting their trade. After numerous amending acts the "Consolidated Hawkers Act, 1888," now regulates the business of hawkers, defining for the purposes of such Act a hawker as a person who *travels about with a horse or other beast bearing or drawing burden*. "The Pedlars Act, 1871," regulates the business of pedlars, a pedlar being therein defined as a person *travelling about without a horse, etc.* Pedlars are subject to control of the police, and are exempt from excise duty. By the Pedlars Act anyone over seventeen years of age, having resided a month in the district and being of good character, can obtain a yearly certificate on payment of a fee of 5s., and is thereupon entitled to exercise such calling in any part of the kingdom. Pedlars have an appeal from the police to the justices of the peace of the district. A hawker's licence costs £2 per annum, and it is granted like a pedlar's licence. He cannot sell spirits, but he may sell tea and coffee. If he deals in plate he must have a plate licence. Those selling goods in fairs or markets legally established do not require any licence.

Hawkesworth, JOHN (d. 1773), author of a book of *Voyages*, containing among others an account of the second and third voyages of Captain Cook, was born probably in 1715. He was early connected with the *Gentleman's Magazine*, and was associated with Johnson and others in starting *The Adventurer*, which was very successful. He also edited Swift's works (1754-55), and some of his *Letters*, adapted several plays for Garrick, translated *Télémaque*, and produced several original

plays which were popular in their day. He was intimate with Dr. Johnson in early life, and very successfully imitated his style, and his portrait was four times painted by Sir Joshua Reynolds. He is supposed to have put an end to his life by an over-dose of opium.

Hawkins (or, more properly, HAWKYNNS), SIR JOHN, seaman and statesman, born in 1532 at Plymouth, made several trading and smuggling voyages to the Spanish Main, and narrowly escaped being caught and hanged there in 1568. In 1572 he entered Parliament for Plymouth, and in the following year was made Treasurer of the Navy. In that post he rendered most valuable services, and introduced many practical improvements of all kinds. In 1588 he commanded as a rear-admiral against the Spanish Armada, with his flag in the *Victory*, and for his valour was knighted by the commander-in-chief. In 1590, with Frobisher, he commanded an expedition to the coast of Portugal, and in 1595, with Drake, led another to the West Indies, but on November 12th in that year he died off Porto Rico. Hawkins, a man of undoubted genius, was the first of our naval reformers, and, but for him, the Armada would scarcely have found an English fleet worthy of the name in a condition even to observe its motions.

Hawkmoths, or SPHINGES, an important section of moths including five families. They have, as a rule, long pointed bodies which extend beyond the hind wings. They are often diurnal or fly by day, a habit which causes them to be confused with the butterflies; they also to some extent resemble butterflies by the antennæ having a thickened area just by the tip. Another character of the family is that the caterpillars usually have a horn just above the tail. The hawkmoths include a large number of species, and, owing to their diurnal habit and large size, include many of the best known of the moths. Thus it includes the famous Death's Head moth (q.v.), the largest of English lepidoptera. The most typical of the sphinges belong to the family *Sphingidae*, of which the Privet Hawkmoth (*Sphinx ligustris*) is the most typical species. This is common in England; it has brown forewings, with black and pink hind wings. Another section of the group are the Elephant Hawkmoths (*Chærocampinea*), so called owing to the possession by the caterpillars of a large trunk-like proboscis. The two best-known English species of this group are the large and small Elephant Hawkmoths (*Chærocampa elpenor* and *C. porcellus*). Another sub-family is that of the *Macroglossinae*. The typical species is *Macroglossa stellatarum*—the Humming-Bird Hawkmoth, so known from its humming-bird-like flight, as they fly rapidly from flower to flower and suck the honey without alighting. The Bee Hawkmoth is a smaller member of the same group. The remaining families are of less importance but include many interesting genera; e.g. the Australian *Synemon* has definitely clubbed antennæ, and thus shows that the character most generally used to separate butterflies and moths is not universally correct.

Hawksbee (or HAUKSBEY), FRANCIS, a distinguished electrician, was born some time after 1650, and became a fellow of the Royal Society in 1705. Next year he invented the first electrical machine, and in 1709 published his *Physico-Mechanical Experiments*. He discovered the "lateral communication of motion in air," constructed an improved air-pump which bears his name, and determined the relative weight of water and air. He died after 1713. A supposed son of his, who died in 1763, is thought by De Morgan to have been the first to give lectures with experiments in London.

Hawkweeds, the popular name for the numerous and puzzlingly similar species of the genus *Hieracium*, belonging to the ligulifloral sub-order of the Compositae, which have mostly yellow dandelion-like flowers, and are natives of the temperate region of the Old World. They have a brownish brittle sessile pappus. The name is said to be derived from the ancient belief that hawks used the milky juice of these plants to strengthen their sight. The ornamental orange-flowered *H. aurantiacum* is known as "Grim the Collier" from the black hairs on the involucle.

Hawse, the situation of a ship's cables before the stem, when a vessel is moored by the bows. Hence the space immediately ahead of a ship at anchor. Hawse-holes are the holes cut for the passage of the cables on each side of a ship's stem. They communicate with the forward part of the lower deck, with the quarters, that is, of the seamen; so that to say "he came into the service through the hawse-holes," is to say that he entered in the lowest capacity.

Hawser, a large rope or cable of three strands. [CABLE.] Strictly, in point of size, it holds an intermediate position between a cable and a tow-line, though the word is now very generally used in the latter sense. Hawser-laid rope is laid or twisted in the way opposite to that in which the individual strands are twisted. To ascertain its strength, square the circumference and divide by 3 for the breaking strain (in tons); by 4 for the proof strain; and by 6 for the working strain.

Hawthorn (i.e. hedgehorn, white-thorn, quick-set or May, *Crataegus Oxyacantha*), a shrub or small tree, sometimes 30 feet high, native to Europe, North Africa, and Western Asia, and naturalised in North America and Australia. It belongs to the sub-order Pomeæ of the order Rosaceæ. The wood is yellowish, hard and tough, but liable to warp; the bark smooth and blackish, the branches numerous with spinously aborted twigs, the leaves scattered, cuneate, irregularly lobed and long-stalked. The sweet-scented flowers, white, or more rarely pink or scarlet, are in corymbs; and the fruit or "haw" is a small, nearly globular, berry-like, red pome, with mealy flesh, a stony core, small withered calyx and 1 to 3 styles. Hawthorn branches are said to have been sacred among the Greeks to Hymen; but, being popularly supposed to be the source of Christ's crown of thorns, it has been considered unlucky. The

variety *præcox*, flowering in January as well as in May, is known as the Glastonbury thorn, legendarily derived from the staff of St. Joseph of Arimathea. The tree has from very early times been set as a live or "quick" hedge. Its wood has been used for cogs, and, though seldom obtained in large pieces, is the nearest approach to a substitute for box for engraving. The leaves have been used instead of tea. The plant is the badge of the Ogilvies.

Hawthorne, NATHANIEL (1804-64), was born of a good New England family at Salem, Massachusetts. He was at Bowdoin College in Maine with Longfellow and Pierce, and very early began to note down his impressions. Though from the first he had made up his mind to become a man of letters, it was long before he made any way. *Fanshake*, his first novel, published in 1828, failed. In the same year he became associated with Goodrich ("Peter Parley"), to whose periodical, *The Token*, he contributed, and for whom he edited several publications. The appreciation shown in England of *Twice-Told Tales*, which also won the approval of Longfellow, gave Hawthorne, in 1837, his first real recognition. Pecuniary success was still, however, wanting, and for two years the young author found it useful to fulfil the duties of weigher and gauger at Boston, the collector there being Bancroft the historian. Being deprived of this by the accession of the Whig party to power, he now went to live with George William Curtis, Margaret Fuller, and others in a community at Brook Farm (q.v.), the organiser of which was Dr. George Ripley. After living with them some months, Hawthorne married Sophia Peabody, and went to live in the old manse near Concord which he has immortalised. Here he remained four years, contributing to the *Democratic Review*, and living a very retired life. In *Mosses from an Old Manse* (1846) he has described the house and its surroundings, and has recorded the effect produced on his mind by its historical associations. From 1846 to 1850 he was again in the employment of the State, this time in the capacity of surveyor of customs at Salem. In his leisure hours he prepared materials for *The Scarlet Letter*, his masterpiece, which appeared in 1850, and effectually established its author's reputation. Thus encouraged he entered upon the period of his greatest activity, producing in 1851 *The House of the Seven Gables*, and in 1852 *The Snow Image* and *The Blithedale Romance*, the last being reminiscent of his experiences at Brook Farm. He also wrote a children's book, *The Wonder Book*, and afterwards, as a continuation, *Tanglewood Tales*. He was, moreover, induced to write a biography of his friend Franklin Pierce, who, at the end of 1852, was the successful Democratic candidate for the Presidency. Hawthorne had declared that he would accept no office if his friend were elected, but he was ultimately persuaded to accept the position of consul at Liverpool, where he remained from 1853 to 1857. He then visited France and Italy, and published in 1860 *The Marble Faun*, written while staying in Yorkshire. After his return to America he wrote some papers for the *Atlantic Monthly*, which were published in 1863 in

book-form as *Our Old Home*. This was his last completed work, and he died at Plymouth in New Hampshire, whither he had gone with ex-President Pierce early in 1864. He was buried at Concord. Two versions of the romance he had left in MSS. subsequently appeared: the one under the title *Septimus Felton*, under the editorship of his elder daughter with the assistance of Browning; the other, called *Dr. Grimshaw's Secret*, was prepared by his son Julian. Hawthorne is not only the first of American novelists; he is also one of the first stylists of the Anglo-Saxon race. His son, JULIAN, born at Boston in 1846, though a clever writer, has inherited but a small portion of his father's power. After finishing his education at Harvard, he passed some years as an engineer at Dresden, but finally became a novelist. *Garter, Sebastian Strome*, and *Dust* are the names of some of his chief works. From 1875 to 1881 he lived in England.

Hay ("cut grass," cognate with the verb *to hew*), grasses and other plants cut and dried as fodder (q.v.). In England the hay-harvest is, under favourable conditions, completed by the end of June or early in July. The crop, which usually consists of natural grasses, sometimes amounts to two tons per acre. The grass should be cut before it runs to seed, as the moister it is the better hay it is likely to produce. In order to preserve its quality after it has been cut, it must be repeatedly turned and dried as speedily as possible. For the latter purpose artificial means are employed when practicable. The common method of drying hay is to shake it and spread it over the field by means of forks or tedding-machines, and after it has remained thus during the day to collect it into windrows or haycocks before nightfall. This process is repeated for two or three days or longer, after which the hay is stacked in ricks. Injury to the hay commonly arises either from stacking it before the natural moisture has been sufficiently removed, in which case it becomes over-heated, or from putting it together when it is wet with rain or dew, which tends to render it mouldy. The latter evil is sometimes remedied by mixing a little salt with the hay. In Scotland clover and ryegrass are usually grown for hay, instead of natural grasses.

Haydn, FRANZ JOSEF (1732-1809), the great Austrian composer, was the son of a wheelwright, and was born at Rohrau, a village on the borders of Lower Austria and Hungary. He underwent a severe early training in singing and instrumentation from a relative named Frankh, and finished his education as a chorister at Stephen's Cantorei in Vienna. After being dismissed for a practical joke from St. Stephens, Josef took pupils and studied the compositions of Emmanuel Bach. Having become acquainted with Porpora, he acted for a time as his accompanist, and received a few lessons from him; but it was Fürnberg who directed his attention to the composition of quartets, and he also it was who recommended him to Count Morzin as musical director. For the latter in 1759 he composed his first symphony. When with him at Lukavec he contracted his

unfortunate marriage. In 1761 Haydn was first employed by the Esterhazys, and five years later became sole kapellmeister to Prince Nicolaus, passionate lover of music. In this year the *Wiener Diarium* wrote of Haydn as the "favourite of our nation." In 1775 his oratorio *Il Ritorno di Tobia* was given in Vienna. *Ritter Rollen (Orlando Paladina)* was composed in 1782, an *Armida* in 1783. The best of his masses were composed in 1782 and between 1796 and 1800. Early next year Haydn accompanied Salomon to London, where his company was much sought after. Six of the symphonies were performed at the Hanover Square Rooms. On his way back to Vienna he had an interview with Beethoven at Bonn, and the latter soon after took lessons from him. In 1794 Haydn paid a second visit to London, where he composed and conducted six symphonies for Salomons, the *Surprise* being frequently given. He was now again engaged by a Prince Esterhazy. In 1797 he composed the *Emperor's Hymn*, and he reached the culminating point of his career when the *Creation* (1798) and *The Seasons* (1799) were produced. Haydn must be considered the father of instrumental music. His masses are still much used in Catholic churches. Among his pupils were the Webers. His title of "Papa Haydn" is an indication of the universal feeling of veneration entertained for him.

Haydon, BENJAMIN ROBERT (1786-1846), a eminent but unfortunate historical painter, was the son of a printer and publisher at Plymouth. His artistic tastes were encouraged by Dr. Bidlake, the grammar-school master, and he afterwards acquired a good general education at Plympton. He was for awhile his father's apprentice, but in 1800 started for London to make his fortune as a artist. He attended the Academy schools and anatomical lectures, and became acquainted with Wilkie, Prince Hoare, and Fuseli. In 1807 his *Joseph and Mary* was hung on the line at the Royal Academy, and was afterwards bought for 10 guineas. His *Dentatus*, inspired by the Elgin marbles (which he was the first Englishman to appreciate), was badly hung in 1809. *Maoet* was next executed for Sir George Beaumont, but the artist was unable to obtain election to the Academy, which, in 1812, he attacked in the pages of the *Examiner*. Two years later his *Judgment of Solomon* created a sensation at the Spring Garden Water Colour Exhibition, and was sold for a large sum. Haydon received the freedom of his native town, where, as well as at Liverpool and Birmingham, the above-mentioned picture was exhibited though with little profit. *Christ's Entry into Jerusalem* occupied him six years, but left him penniless at its completion. His next picture, *Lazarus*, was seized by his creditors, and sold for £30, and he had to go to prison. In 1835 he began to lecture, and this form of work afforded him much relief. His last years were embittered by his not obtaining a commission to decorate the walls of the Houses of Parliament and by the failure of an exhibition at the Egyptian Hall; an in despair he shot himself.

Hayes, RUTHERFORD BIRCHARD (1822-93), 19th President of the United States of America, was born at Delaware, Ohio, where his father was a merchant. He was educated at Ohio and Harvard, and having been called to the Ohio bar practised at Cincinnati till 1861. He served as a volunteer in the Federal army during the war, and rose to the rank of major-general. He was first returned to Congress for Ohio in 1865, of which state he became governor two years later, and again in 1869 and 1875 held the same position. In 1876 he was Republican candidate for the Presidency, but was returned only by very questionable procedure. There were double returns in Louisiana, Florida, and Oregon, and an Electoral Commission, in which the Republicans had a majority, decided by one vote only that the Republican set was genuine. The chief events of Hayes's presidency were an attempted reform of the Civil Service, which was thwarted by the opposition of his supporter Conkling; the withdrawal of troops from the Southern States, and his conflict with Congress on the silver question, the Monetisation Bill being carried against his veto in 1878. After his retirement from office he took little further part in public life.

Hay Fever, a peculiar disease, the prominent feature of which is nasal catarrh. Its attacks are confined to certain subjects who from some peculiarity of constitution are susceptible to the disease. In them it recurs year after year, usually during the month of June, and the patients are quite free from the disease at other seasons. Hay fever is said to be produced by the pollen of grasses, which, floating in the air during the early summer months, irritates the mucous membranes of those who are subject to the malady. Some alleviation may be procured by the use of tonics or by the change of air, but the disease is a peculiarly intractable one.

Haynau, JULIUS BARON VON (1786-1853), an Austrian general, whose name became notorious, was born at Cassel. For his severities in the campaign of 1848-49 in Italy he gained the name of the "Hyæna of Brescia," and in crushing the Hungarian rising which followed, showed equal ruthlessness. He entered the Austrian service in 1801, and became field-marshall in 1844. In spite of his distinguished services in the Hungarian war, when he stormed Raab and won several battles on the Meiss, he was dismissed the service for "intractability" in 1850. He then travelled, and during a visit to London was assaulted at the brewery of Barclay and Perkins. He denied the charge of flogging women, and a biography by Baron Schönhaas attempted a general defence of his character.

Hayti (HAÏTI), or SAN DOMINGO, a large West Indian island, lying to the south-east of Cuba and east of Jamaica. It is divided into Hayti, the western and smaller part of the island, and the republic of San Domingo or "Dominican Republic" (not to be confused with Dominica, q.v.), the larger eastern portion. Discovered by

Columbus in 1492, its history has probably been more troublous than that of any country in the world. The Spaniards soon almost exterminated the original inhabitants, and African negroes, first introduced in 1505, or their mulatto offspring, form a very large section of the population. French buccaneers soon after came from the island of Tortuga to Hayti, and settled chiefly in the western half of the island. This portion was ceded to France by the Treaty of Ryswick (1697). There were thus three races: the whites, the blacks, and the mulattoes. The last of these were free, but enjoyed no political power, till in 1791 a bitter race struggle broke out, which ended in the extermination of the Europeans. A French expedition defeated and captured the coloured leader Toussaint l'Overture (q.v.) in 1801, but France was unable to maintain her hold upon the island, and in 1804 Dessalines took the title of Emperor of Hayti. Revolution now followed revolution, the island being sometimes one, sometimes divided; the government, at one time monarchical, at another republican. For a time there was peace under the rule of President Boyes, who governed the whole island from 1822-43; and the independence of Hayti proper was acknowledged by France in 1825 in consideration of pecuniary compensation to the planters. In 1843 the Dominican Republic was formed; but in Hayti, Sonlouque in 1849 assumed the title of emperor. Ten years later, however, a republic was proclaimed. In 1867 it was enacted that a president should hold office for four years, but at present (1910) the office is tenable for seven years, under the constitution promulgated in October, 1889. The Republic has an army 7,000 strong and a navy of six cruisers. The religion is nominally Roman Catholic, there being an archbishop and four bishops, but serpent worship and cannibalism are by no means unknown. The area of the whole island is 29,830 square miles, and of Hayti 9,242. The soil of Hayti is fertile, but is badly cultivated. Cotton, rice, yams, tobacco, maize, cocoa, and several fruits are among the natural products; and mango, sugar, coffee, and indigo are grown. Mahogany, satinwood, and rose-wood are obtained from the forests. The island is mountainous, as its name betokens; the highest peak, Lorna Tina, is over 10,000 feet high. Earthquakes are frequent, but there are no volcanoes. The rivers are unimportant, but there is a large salt lake, Euriquillo, near the centre of the southern coast. There are heavy rains in May and June, and hurricanes are not infrequent.

The commercial state of the republic of Hayti is naturally not prosperous. The chief exports are coffee, cocoa, cotton, logwood, and mahogany; the imports come chiefly from the United States. There is a large floating debt. Elementary education is provided free, there being 400 national schools. The estimates of revenue and expenditure are generally held to be valueless. The language (in Hayti proper) is a corrupt French. Port-au-Prince is the chief town in Hayti. The Bay of Gonâves contains excellent harbours; in it is the island of Gonâves belonging to the republic. To the north is Tortuga, also attached to Hayti. An

interesting description of the country by Sir Spenser St. John, formerly Consul-General (*Hayti; or, the Black Republic*), was published in 1884.

Hayward, ABRAHAM (1801-84), a well-known essayist; born in Somersetshire, was called to the bar in 1832, and became Q.C. in 1845. He founded and edited the *Law Magazine*, but distinguished himself rather as a man of letters than as a lawyer. He translated the first part of *Faust* (1833), and wrote much for the *Quarterly Review* and other periodicals and newspapers, the best of his articles being republished in three series of *Biographical and Critical Essays* and in *Sketches of Eminent Statesmen and Writers*. He was a great favourite in society, and published works on *The Art of Dining*, and the rules of whist. He also edited *The Autobiography of Mrs. Piozzi*. His *Select Correspondence* appeared in two volumes in 1886.

Hazaras, the inhabitants of the mountainous region of North Afghanistan between Kabul and Herat, who are undoubtedly of Mongolo-Tartar origin, though now speaking a mediæval form of Persian and belonging to the Siah or Persian division of the Mohammedan religion. They are called Moghel, i.e. Moghuls, by their Ghilzai neighbours, and their Mongol descent is clearly shown in their Kalmuck features, small oblique eyes, high cheek-bones, flat beardless face, and long black hair. Some claim descent from the Koreish Arabs, others from the Toghiani Turks, and others, with more probability, from a number of Mongol families left in this region by Jenghiz Khan, who were afterwards joined by others in the time of Timur Beg (Tamerlane). The national name *Hazara*, meaning "a thousand," probably has reference to the innumerable tribal groups into which they are divided, and each of which is governed by its own chief, either a sultan, a khan, a beg, a vali, a mir, or a mehtar, while all recognise the suzerainty of the Ser Khanah ("Head of the House"), who in his turn is dependent on the Amir of Afghanistan. These chiefs, however, are often at war with each other, and seldom combine except to resist the Amir's tax-gatherers or to join in a plundering expedition against some powerful neighbour. The Hazaras allow a large share of freedom to their women, who generally control the domestic relations, take part in the tribal assemblies, and even join in the raids mounted on horseback. South of the Hazaras dwell the kindred Elmaks, from whom they differ little except that the former are violent Shiahs, the latter rigid Sannis. (C. M. Macgregor, *Afghanistan*, p. 246.)

Hasel (*Corylus Avelana*), a shrub or small tree belonging to the order Corylaceæ and native of Europe, North Africa, and Western Asia. Its wood is reddish, close-grained and flexible; the bark, a mottled bright brown; the twigs pubescent; the leaves scattered, short-stalked, irregularly serrate, downy and roundish, turning yellow in autumn. The flowers are monoeious and precocious, occurring, that is, before the leaves in February or March—the male in pendulous yellow catkins and the female in small oval sessile, ascending catkins

with crimson stigmas. The bracteoles unite to form the leafy *cupule* or husk to the nut, which in the filbert (q.v.) is enclosed by it. A variety (*purpurea*) has handsome bronze-purple foliage. The wood makes excellent crayon and gunpowder charcoal, and the coppice-shoots are used for hurdles, hoops, hampers, and walking-sticks. A hazel wand is generally used as a divining-rod, and the name is said to be derived from its being the primitive royal sceptre. The American *Hamamelis Virginica*, from which Pond's Extract is prepared, is sometimes known as witch-hazel. The hazel is the badge of the clan Colquhoun.

Hazlitt, WILLIAM (1778-1830), one of the best English critics, was born at Maidstone, where his father was a Unitarian minister. He was educated for the ministry of that denomination, but early abandoned the notion of entering it. His Unitarian connection, however, gained for him the acquaintance of Coleridge, in whose company he also met Wordsworth in 1799. For a few years he devoted his time to painting, and his portrait of *Lamb as a Venetian Senator* is in the National Portrait Gallery; but he soon abandoned art for his true vocation as a man of letters. He had, indeed, so early as his fourteenth year, contributed to a paper, and in 1806 was published his *Principle of Human Action*. In 1812 he settled in London, living in a house in Westminster belonging to Jeremy Bentham. He soon became connected with the *Morning Chronicle*, and afterwards with Leigh Hunt's *Examiner*, for which, with Hunt, he wrote the series of essays called *The Round Table*. He also occasionally contributed to the *Edinburgh Review*. As a lecturer he was very successful, his lectures on the English comic writers, on the English poets, and on the dramatic literature of the reign of Elizabeth, all of which were published, being his best efforts. Most of his essays first appeared in the *London Magazine* and Colburn's *New Monthly*, including those afterwards contained in *Table Talk* and *The Plain Speaker*. His *Characteristics* (1823-27) were an imitation of Rochefoucauld. The *Characters of Shakespeare's Plays* was Hazlitt's most popular work, but probably his *Review of the English Stage* was the most valuable. The *Life of Napoleon* showed him at his worst. Hazlitt, though his reading was not wide and included no Greek or German authors, was a versatile as well as an acute writer. His political opinions seem to have been chiefly negative, but he was virulently attacked by the Tory writers, and in one instance, at least—his letter to Gifford, the editor of the *Quarterly Review*—he replied with triumphant bitterness.

Head, in *Hydraulics*, signifies difference of level. A head of water causes flow, if a suitable conductor for the water exists between the points concerned. [HYDRAULICS.]

Head, SIR EDMUND WALKER (1805-68), an able Colonial governor, was the son of an Essex clergyman. He was educated at Winchester and Oxford, where he held a fellowship of Merton for seven years. In 1841 he was made a Poor Law

Commissioner, and an article by him on *Settlement* in the *Edinburgh Review* was circulated as a reprint by Government authority. From 1847 to 1854 he was Governor of New Brunswick, and from the latter year till 1861 was Governor-General of Canada. After retiring from this post, he became a Civil Service Commissioner. He was an intimate friend of Sir G. C. Lewis (q.v.), whose *Essays on the Administrations of Great Britain* he edited, and was also an accomplished linguist.

Head, SIR FRANCIS BOND (1793-1875), a Colonial statesman entirely unconnected with Sir Edmund, was born at Higham, and, having received a military education, entered the army, and was present at Waterloo. In 1825 he retired on half-pay, to become manager of the Rio Plata Mining Association, but the enterprise was unsuccessful. Ten years later he accepted the appointment of Lieutenant-Governor of Upper Canada, which he administered with great ability, and in 1837 put down an insurrection. On returning home he wrote a good deal for the *Quarterly Review*, where he published his narrative of affairs in Canada. He was created a baronet in 1836, and a Privy Councillor in 1867. In *The Emigrant* he gave an account of his return from Canada, when his life was in danger; and he also published *Bubbles from the Brunnen of Nassau*, by an Old Man, a Life of Bruce (the traveller), and a description of his life in South America.

Headache is a symptom met with in many forms of disease. It occurs in various kinds of intracranial mischief; it is a distressing symptom in most species of fever; it occurs in Bright's disease, in anaemia, in various uterine conditions in women, and in association with disturbances of the digestive system (the common bilious headache). A variety of headache recurring at intervals and sometimes involving only one side of the head is known as hemicrania or megrim. [MEGRIM.] Lastly, headache sometimes occurs apart from other symptoms, as the result of worry and over-work of the brain. The term headache is not applied to every form of pain in the head; it must be distinguished from neuralgia of the nerves of the scalp, from the pain of ear disease, of glaucoma, and from the pains of inflammation of the bones of the skull. In children who complain of headache it will not infrequently be found that the eyes are at fault, and many a headache occurring in young persons has been cured by prescribing a suitable pair of glasses.

Head Injuries. An injury to the head is always a matter for serious consideration, and, however slight the mischief may at first sight appear, the possible complications which may supervene should render it imperative that the most careful precautions are taken. Injuries of the head may be divided into simple contusions, wounds of the scalp, extravasation of blood within the cranial cavity, fracture of the skull, injury to the brain or its membranes and nerve lesions. Various complications of head injuries are met with. Erysipelas is the commonest of these. In

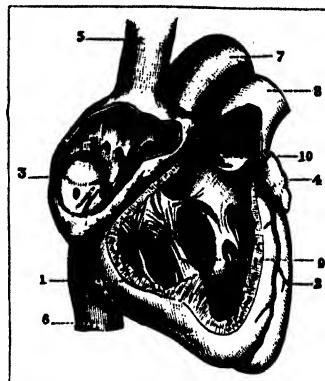
severe injury inflammation, leading to the formation of matter within the skull, may occur, and in rare instances a portion of brain substance may protrude through a wound in the bony case of the skull, a condition which is known as hernia cerebri. Fracture may involve the vertex or the base of the skull. A characteristic symptom of fracture of the base is the escape of blood or cerebro-spinal fluid from the meatus of the ear. Injuries of the brain itself have been discussed under CONCUSSION. In certain head injuries it is sometimes necessary to perform the operation of trephining the skull.

Headon Beds, a subdivision of the Oligocene (q.v.) of the Isle of Wight, so named by Edward Forbes, which vary in thickness from 133 feet at Headon Hill to 175 feet at Whitecliff Bay. They consist of green shelly sands and marls or limestones, mainly of fresh-water origin, but with some brackish and marine beds in the middle of the series. They rest conformably upon the Upper Bagshot Sands, and are similarly overlaid by the Osborne series. Among the most characteristic fossils are *Planorbis euomphalus*, *Lymnaea cavigata*, and *L. longicosta*, and *Viviparus lenta* in the fresh-water beds, *Potamides cinctus* in the brackish ones, and *Cytherea (Venus) incrassata* and *Neritina conura* in the marine ones. At Hordwell or Hordle Cliff, near Lymington, the lower part of the series has yielded turtles, snakes, an alligator, a crocodile, the fresh-water bony-pike *Leydigosteus*, several birds, the ungulates *Palaeotherium* and *Anoplotherium*, the insectivorous *Spalaeodon*, and the carnivor *Hyenodon*. At Brockenhurst the marine Middle Headon series has yielded numerous fossils, including fourteen species of corals.

Heart. The human heart lies enclosed in a serous sac, the pericardium, in the cavity of the chest between the two lungs; its base, from which the large blood-vessels conveying blood from and to it take origin, is situated behind the sternum or breastbone. At the level of the second intercostal space, its apex impinges against the external wall of the chest at a point situated on the fifth intercostal space, a little internal to a line drawn vertically downwards through the nipple. The heart contains four chambers, two auricles and two ventricles. Looking at it from the front, portions of the muscular wall bounding each of these chambers are visible, the right auricle lying above and to the right, the left auricle above and to the left, the right ventricle and left ventricle being situated beneath the auricles on the right and left sides respectively. Furthermore, however, it should be mentioned that the right ventricle lies, broadly speaking, in front of the left ventricle, so that from the anterior aspect a large portion of the wall of the right ventricle is seen, while the wall of the left ventricle appears only at the extreme left border of the portion of the heart that is visible. The edges of the lungs overlap the anterior aspect of the heart on each side, leaving only a small portion of cardiac muscle uncovered by lung. It is this uncovered portion of the heart which gives rise to what is known as the area of *cardiac dulness*. On percussion of the chest wall, in situations beneath

which lie resonant lung substance, a different note is obtained to that which results when the chest overlying the non-resonant heart substance is percussed. In this way a dull sound obtains where the heart is uncovered by lung, over a triangular area in front of the chest, the area of cardiac dulness. The large veins conveying blood from the head and upper extremities (superior vena cava) and from the trunk and lower extremities (inferior vena cava) empty themselves into the right auricle, and from the right auricle, the natural direction of the blood current, into the right ventricle through an aperture, the *auriculo-ventricular opening*, which is guarded by a valve called the *tricuspid valve*. From the base of the right ventricle the pulmonary artery takes origin and conveys the blood squeezed out of the contracting ventricle to the lungs. After undergoing aeration in the lungs, the blood is returned to the left auricle of the heart by the pulmonary veins; it then passes through the left *auriculo-ventricular opening*, which is guarded by the bicuspid or mitral valve into the left ventricle and from thence is discharged, when that ventricle contracts, into the aorta, and so to the several arteries of the body. At the origins of the pulmonary artery and aorta there are the two sets of semilunar valves, three in each vessel. These valves offer no opposition to the flow of blood from the ventricles into the pulmonary artery and aorta respectively; but the semilunar folds become closely apposed and prevent any back flow of blood from the two great arterial trunks into the ventricles. In the same way the *auriculo-ventricular valves* (tricuspid and mitral) offer no obstacle to the flow from the auricles to the ventricles, but when the latter cavities become filled the valves are floated up, their cusps come into close apposition with one another, and form a barrier which prevents any back flow from the ventricles into the auricles. The delicate membranes or cusps of the *auriculo-ventricular valves* are attached at their bases to the

of the ventricles. This arrangement of *chorda tendinæ* *musculi papillares* contributes to maintain the effectiveness of the barrier formed by the valve cusps between ventricle and auricle, when the ventricles become full, by preventing the eversion of the flaps of valve membrane into the auricular

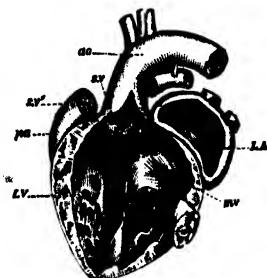


SECTION OF HUMAN HEART (RIGHT SIDE).

1 Right ventricle; 2 left ventricle; 3 right auricle; 4 part of left auricle; 5 superior vena cava; 6 inferior vena cava; 7 aorta; 8 pulmonary artery; 9 muscular column and tendinous cords (attached to the tricuspid valve); 10 semilunar valves.

cavity. The heart beats about seventy-two times a minute, and the several events corresponding to each beat occur in a certain sequence and constitute what is termed the *cardiac cycle*.

These events comprise the alternate contraction (*systole*) and relaxation (*diastole*) of the auricles and ventricles. Commencing with the auricular systole, which is sharp and sudden and expels the blood from the right auricle into the right ventricle, and from the left auricle into the left ventricle respectively, the next and immediately succeeding event is the ventricular systole, which drives the blood contained in the right ventricle into the pulmonary artery, and that contained in the left ventricle into the aorta. While the ventricles are contracting, the auricles are passively dilating, that is, they have entered upon their period of diastole, and as soon as the ventricular contraction is over the ventricles too are in diastole, and thus for a brief space the muscular tissue of all four cavities is in a state of quiescence. This period is known as the heart's pause, and completes the cycle of events. Each series comprising auricular systole, ventricular systole, and pause is repeated, as already stated, about seventy-two times a minute, small as the space of time is, occupied by the several events in a cardiac cycle, it has been found possible to determine with considerable accuracy the duration of each event. Roughly speaking, if a cycle be divided into five parts, less than one of them will be occupied by the contraction of the auricles, about two parts by the contraction of the ventricles, and rather more than



SECTION OF HUMAN HEART (LEFT SIDE).

LV, Left ventricle; LA, left auricle; mv, mitral valve; pa, pulmonary artery; sv, semilunar valves of pulmonary artery; ao, aorta; sa, semilunar valves of aorta.

heart wall at the junction of the auricles and ventricles. From the under surfaces of the valve membrane spring a number of fine cords (*chorda tendinæ*) which communicate through small muscular columns (*musculi papillares*) with the walls

two parts by the pause. On listening over the heart region two sounds occurring in quick succession, followed by a period of silence, are observed in correspondence with each cardiac cycle. A dull first sound, a short and sharp second sound, and then the afore-mentioned interval. This series of events may be represented by the sequence "lubb dup—" repeated about seventy-two times a minute. The impulse of the heart (apex beat) can be felt in the situation already alluded to, and if its time of occurrence be compared with that of the sounds heard, it will be found to take place just at the moment when the first sound is heard. The first sound is probably in part a muscular sound produced by the contraction of the muscular fibres of the heart, and in part due to the vibration of the apparatus of the auriculo-ventricular valves, put on the stretch as the cusps float up and prevent the escape of the blood from the ventricles into the auricles. The second sound is, no doubt, due to the sudden closure of the semi-lunar valves as they come into apposition and prevent any back-flow from the arteries into the ventricles. The natural heart sounds undergo alteration, and may be quite obscured and replaced by abnormal sounds known as *bruits* or *murmurs* in diseased conditions of the valves. Thus it is customary to speak of *aortic murmurs*, *mitral murmurs*, and the like. By careful study of the exact point in the cardiac cycle at which such an abnormal sound occurs, and by carefully noting the situation on the external chest wall in which each sound is best heard, and the direction in which it appears to be propagated, much has been learnt with respect to valvular disease.

Diseases of the Heart. Various inflammatory conditions affect the heart. The outer serous coating, pericardium, is apt to be involved in the course of acute rheumatism, in pyæmia, etc. This condition, *pericarditis*, is at all times a serious one, and may lead to grave embarrassment of the heart's action. If the muscular substance itself undergoes inflammation, the term *myocarditis* is applied to the disease. Finally, the internal lining membrane of the heart, the endocardium, is particularly liable to become inflamed, and when this is the case *endocarditis* is said to exist. In endocarditis the valves are more prone to suffer than is any other portion of the internal lining of the heart, and curiously enough the valves of the left side of the heart are much more commonly attacked than those of the right side. Acute rheumatism (rheumatic fever) is the usual exciting cause of valvular disease, and as the result of the inflammation which occurs in rheumatic endocarditis minute granulations of effused lymph are formed, mainly in the situations where the flaps of the valves come into contact, and scar tissue is subsequently developed and considerable deformity of structure may result. The aortic and mitral valves in this way not uncommonly become so altered in shape as to materially impair their effective action. They may be so thickened and unyielding as to offer considerable resistance to the flow of blood through them (aortic obstruction and mitral obstruction), and, on the other hand, the failure of their surfaces

to become accurately apposed to one another when the valve shuts may lead to a back-flow of blood (aortic regurgitation and mitral regurgitation). The degenerative change known as atheroma is also productive of alteration in the valves, particularly in the aortic valves. Each form of valvular disease is associated with characteristic morbid sounds (*bruits*), and these readily guide the physician to his diagnosis of the particular condition which obtains. The heart makes a considerable effort to deal with any valvular defect which may exist, and excess of work being thrown upon one or other chambers of the heart an attempt is made to obviate the difficulty by overgrowth of the muscular tissue of the chamber or chambers involved. In this way *hypertrophy* of the heart results, and in some instances the organ may continue for many years to struggle with adverse circumstances, and a condition of compensation is said to exist. In many instances, however, the natural effort is not able to keep pace with the disorganisation of the mechanism produced by the valvular disease. There is more and more difficulty in maintaining the circulation, the chambers of the heart, particularly of the right side, become dilated, and the obstruction makes itself manifest in dropsical condition of the extremities, or may be in engorgement of the lungs. A particular form of endocarditis, acute ulcerative endocarditis, sometimes occurs. This disease, which usually proves fatal, has been much studied of recent years from the bacteriological standpoint. Altogether apart from valvular disease, the heart muscle is liable to become hypertrophied in certain forms of Bright's disease, particularly in that condition which is known as *chronic interstitial nephritis*. The muscular walls of the heart are also liable to certain degenerative processes. Of these the most important is that known as *fatty degeneration*. Lastly the subject of *congenital* disease of the heart should be mentioned. The heart in such a case is malformed from birth, a common defect being a constriction of the orifice of the pulmonary artery with imperfect development of the *septum* or partition between the two ventricles. A striking symptom which accompanies this condition is *cyanosis*, that is lividity due to imperfect aeration of the blood.

Heartburn. [INDIGESTION.]

Heartsease and **Pansy**, the best known of the many popular names for the cultivated forms of *Viola tricolor*, a very variable and mainly European species of violet, with large spreading pinnatifid leafy stipules to its long-stalked leaves, and flowers varying much in colour and size, but never cleistogamous (q.v.), as in most other violets.

Heart Urchins, a general name to include the sea urchins of the order Spatangoidea (q.v.). These have the mouth on the lower side, and, as a rule, some distance from the centre toward the anterior margin. The mouth, as a rule, is oval, and has two lips, and is not surrounded by a floscule as in the allied order the Cassiduloidea. The anus is either also on the lower side or on the posterior

margin. The best-known member of the group is the common Heart Urchin (*Spatangus purpureus*, O.F.M.), common on some parts of the English coast. Some well-known chalk fossils, such as *Furciaster oranginum*, also belong to this series.

Heat is now regarded as a special kind of motion of the particles of any material substance, whether solid, liquid, or gaseous. We are able to distinguish this kind of motion by our sense of touch, not by the sense of sight or of hearing; though it is not inconceivable that beings may exist whose sight or hearing are sufficiently refined to perceive with their eyes the existence of heat in a body. Ordinary beings, for example, can recognise that a tuning-fork is vibrating, by applying it either to their ears or to their teeth. All invisible molecular motions can be regarded as heat, and it must be understood that heat-motion can be transformed into other invisible motion, and so cause an apparently entire disappearance of heat. When thus transformed, it is called *latent*, but the term is obviously incorrect, and was, in fact, given when totally erroneous impressions of the nature of heat were held by physicists. [CALORIC.] The various elementary facts concerning heat in its many applications are described in separate articles, and need not here be repeated. When a body is in motion it is said to have kinetic energy. A body containing heat, therefore, possesses energy, and it is usual to define heat as a form of energy and to measure it in the same way. The principle of conservation of energy states that it can never be destroyed though it may be transformed. [CONSERVATION OF ENERGY.] So if heat is given to a body, and does not manifest itself in an intensification of those properties that we know by experience to be due to the heat of the body, we infer that it possesses energy in some other form, and that, by suitable means, we may get the energy back either as heat or as some other manifestation. Intensification of heat motion shows itself in what is called a rise in temperature (q.v.), which may conveniently be defined as heat intensity. A subtraction of heat from any body causes a fall of temperature, and the body is said to become colder. Cold is, therefore, not a definite entity like heat; it is merely the absence of motion. A body without any heat motion would be at a truly absolute zero of temperature, and, therefore, absolutely cold; it could in that state suffer no further lowering in temperature. Molecular heat motion may be regarded, though not with absolute certainty, as some form of vibrating motion such as a backward and forward linear motion, combined with rotation of the particles. Such individual motions tend to keep the particles apart from each other, and, if intensified, it would appear natural that each particle would demand more space for its movements, and the whole mass of the warm body occupy a greater space than before. Such is found to be actually the case; most bodies expand on heating and conversely contract when cooled. [EXPANSION.] Certain properties of substances, such as resistance to the passage of an electric current, are found to suffer change when the body changes in

temperature; regarding the transit of electricity as being effected by the material particles themselves, and not by the spaces between them, such changes are not surprising, when we regard these spaces as diminishing with a lowering of temperature. Taking the extreme case of a body at absolute zero of temperature, molecular motion no longer exists, and that hindrance to close contact of the separate particles is removed. The electrical resistance under such circumstances is likely to be entirely removed—at any rate for particles that are identical in character with each other, such as those of a pure metal. The particles of a body are not all possessed of exactly the same intensity of motion, though their frequent impacts with each other are likely to assist in distributing such motion uniformly throughout the mass. The degree of their intimacy is an important consideration in determining their readiness to transmit heat motion from one portion of the mass to another. This power of transmitting heat is called *conduction* (q.v.), and from the above considerations it will be seen that, as a rule, good conductors of electricity should also be good conductors of heat. This is found by experiment to be the case, and the converse also generally holds that bad conductors of heat are bad conductors of electricity. The few experiments that have been made on the change of conductivity of heat on a metal for different temperatures, demonstrate the significant fact that the resistance to flow of heat, like that of electricity, diminishes as the temperature is lowered. One of the most powerful reasons for believing that heat is a vibratory motion is that it can be transmitted through free space by radiation (q.v.), that is, by oscillatory motion transmitted through the ether (q.v.), without the assistance of material particles. Radiation is not heat, but it is a transfer of vibratory motion. A hot body can supply heat to produce radiation, and will, therefore, become colder. Any body containing heat surrounded by a medium capable of radiation will continually give out heat, even if it be the coldest body in any system, since it cannot help giving motion to the medium surrounding it. In fact, all bodies continually give out heat, and all continually receive heat; those that are hottest will give out more than they receive; those that are coldest receive more than they emit. This is known as the theory of exchanges (q.v.), due originally to Prévost and expanded by Stewart. The tendency is always to cause an equal distribution of intensity of heat. It depends upon the nature of the substance whether it readily accepts radiation that passes into it. Just as certain substances are transparent to light and allow it to pass through readily without being affected thereby, so there are substances transparent to heat. These are called *diathermanous*, and are exemplified in rock-salt, and in liquid oxygen. Such substances might remain at very low temperatures, in a much warmer enclosure, if well surrounded by a very good vacuum.

It has been stated that heat, being a form of energy, may be measured in energy units. A quantity of heat may, for example, be expressed in foot-pounds (q.v.) or ergs (q.v.). Nevertheless, the

existence of units of temperature-increase [CENTIGRADE, FAHRENHEIT], long before the dynamical theory of heat was propounded, involved the adoption of other units. The *calorie* for instance is the amount of heat necessary to raise the temperature of one grammme of water one degree centigrade. This has its equivalent in foot-pounds or ergs, and it is to Dr. Joule that we owe a variety of exact experiments to determine their relation. His investigations show that the *mechanical equivalent* of the calorie is approximately 42×10^6 ergs.

The statement of this relation is known as the First Law of Thermodynamics. If we now suppose a calorie of heat to be given to one grammme of iron, theory helps us to see that its temperature will not suffer just an increase of one degree; and if the calorie be given to copper, the temperature increase will be different to that of iron. For an atom of copper is heavier than an atom of iron, their masses being in the ratio of 56 to 63. Thus one grammme of copper will contain fewer atoms than one grammme of iron, their number being in the ratio of 56 to 63. So equal quantities of heat applied to equal masses of each metal will raise the temperature of the copper more than that of the iron. The number of calories required to raise one grammme of any substance through one degree is called its *specific heat* (q.v.), and the above considerations lead to the conclusion that for simple substances and for compounds of similar composition to each other the specific heats are inversely proportional to the atomic weights. This is known as Dulong and Petit's law. The specific heat of water is unity, by definition of the calorie. All other substances have specific heats less than unity, excepting hydrogen gas, whose specific heat is 3·4. Concerning gases it may be stated that the specific heats are the same for equal volumes of all simple gases that are not near to their vaporous condition, which is really only another way of stating Dulong's law.

The most marked effect of heat on a substance is that of changing its state from solid to liquid, or from liquid to the gaseous. While the change is going on, there is no temperature increase; all the heat absorbed goes to change the state, without, as a rule, changing the temperature. Such heat is transformed into molecular motion other than heat motion, and shows itself in the greater freedom possessed by the particles of the substances, after the change has been effected. Thus the particles of liquid water are capable of much greater freedom than those of ice; and particles of steam are still more richly endowed with energy of motion whereby they may travel through space freely. A definite amount of energy is required to change the state of every substance in the same way, 80 calories for the conversion of ice at 0° C. to water at the same temperature, and 537 calories for water to steam at 100° C. Certain substances, in changing from solid to liquid, require a small range of temperature for the process. Wrought-iron, for example, passes through a plastic state in its change from solid to liquid—a fact of much practical importance in the arts. [WELDING.] The same occurs with ice, but the plastic state

lasts for a much smaller range of temperature. [REGELATION.]

The practical application of heat-energy for the performance of work depends on the conversion of the invisible molecular heat-motion into visible motion of aggregations of molecules. The process is therefore only directive, and if we were able to control individual molecules better there is no reason why we should not be able to get energy out of any warm body. But all heat-engines depend upon the use of two temperatures; heat-energy will not flow freely from a body, leaving less therein, unless its temperature be higher than that of its surroundings. This is known as the Second Law of Thermodynamics. The greater the difference of temperatures employed in the engine, and the lower the highest temperature employed, the more efficient will it be. The maximum efficiency possible is, in fact, calculated to be $t_2 - t_1 \div 273 + t_2$, t_2 being the highest temperature employed in the substance (steam, gas, or hot-air) whose heat-energy is being converted, and t_1 its lowest temperature, both being expressed in centigrade degrees. [GAS ENGINE, STEAM ENGINE.]

Heath, the common name of the species of the genera *Calluna* and *Erica*, which belong to the gamopetalous family Ericaceæ. They are evergreen under-shrubs with wiry stems, small narrow evergreen leaves generally in whorls, four sepals, a bell-shaped or tubular corolla of four petals, eight stamens, and a four-chambered capsule. The best known is the heather or ling, *Calluna vulgaris*, which has a pink calyx. It grows socially on the poorest soil and at considerable elevations, covering the moors of Scotland and the north of England, and affording shelter and, in its shoots, food to the grouse, black game, and mountain hare. It is made into brooms, brushes, baskets, or thatch, and is used as fuel, whilst formerly it was used in brewing, tanning, and dyeing. It is the bed of the mountaineer, and one not to be despised. It forms the badge of the clan M'Donell.

The crimson or fine-leaved heath, *Erica cinerea*, with leaves in whorls of three, and deep-red flowers also in whorls, occurs on lower moors often as abundantly as ling. It is the badge of the M'Alisters.

E. Tetralix, the cross-leaved heath, with four leaves in a whorl and an umbel of pale pink flowers is common, but seldom so abundant as the two before-mentioned. It is the badge of the M'Donalds.

There are several other species (*E. vagans*, *E. citarris*), in Cornwall and Ireland, the headquarters of the group being South Africa. All heaths are rich in honey.

Heather. [HEATH.]

Heathfield, Lord (1717-90), an English general, is better known as General Elliot. He was born at Stobs, Roxburghshire, the seat of his father, Sir Gilbert. Educated at Leyden, Woolwich, and La F're (a French military college), he entered upon a long military career, during which he saw service in three great wars. He was wounded at Dettingen, in the Austrian Succession War, and

from 1759 to 1761 was with Frederick in the last period of his seven years' struggle. The culmination of his career was reached when in the next war he successfully defended Gibraltar from June, 1779, to the beginning of 1783, destroying the Spanish ships with "Elliot's red-hot balls." He was created a peer in 1787.

Heating. The attainment of a suitable temperature for any definite purpose may be brought about in various ways. The high temperatures necessary for steam boilers, for example, are produced by complete combustion of coal, gaseous or liquid fuel, in a confined space in close proximity to the boiler. A conservatory is generally of glass, through which the bright radiant heat from the sun may pass, without being able to return, and so the internal temperature is gradually rendered greater than the external. Ordinary English rooms are warmed by open grates containing burning coal or wood, a certain low percentage of the total heat emitted passing into the room as radiation. A gas-burner or oil lamp in a room radiates heat in all directions, and also allows the hot gaseous products of combustion to assist in warming; it is thus a fairly efficient heater, but a disagreeable one on account of the deleterious effects of the gases that pass into the air. Close stoves prevent these combustion-products from passing into the air, but they may be efficient heaters if their flues have a considerable surface-area within the room before leading to the chimney. These flues rapidly get heated, and so radiate heat into the room, the actual products of combustion being comparatively cool by the time they reach the chimney.

Heating by means of gas is discussed under the article **GAS HEATING**. It is here desirable to mention the chief modes of heating by hot water and hot air.

Hot-water heating is now effected by one of two systems, high-pressure and low-pressure. In the high-pressure system small wrought-iron pipes of great strength pass from a *boiler-coil* in the furnace upwards through the set of rooms, etc., in the building to be warmed. The boiler-coil is simply that part of the arrangement which acts as a boiler and which is composed of lengths of pipes in series instead of a single boiler-shell, for the sake of extra strength and greater heating surface. The pipes rise to the highest part of the building, and then return by vertical stretches to the boiler-coil again. The system forms a complete circuit, through which water flows to the exclusion of all air except such as is dissolved in the water. But to allow for expansion of the water on heating a special cylindrical expansion-pipe is attached to the topmost portion of the circuit. It contains air, and is so placed that expansion of the water is permitted therein by compression of the air. When the furnace is fired the water in the coil becomes hot, and rises by reason of its lightness as compared with that of the colder column of water in the return pipe. The speed of flow is kept up continually by this difference of temperature between the supply and the return, the latter always

being at the lower temperature on account of the heat losses during the flow through the building. The whole circuit being of great strength, it is possible to raise the temperature safely up to 200° C. The water being completely enclosed, it does not boil, but its pressure rises to perhaps ten atmospheres. The speed of flow is very great, but the working seems safe.

In the low-pressure system the same theoretical conditions hold for the flow of water, but the pipes are larger, the boiler is of the more usual form, and the speed of flow is much lower. It has the advantage over the other systems of supplying a more uniform temperature; the pipes are not so inconvenient to touch, and do less harm by contact with woodwork, etc. But the high-pressure system employs smaller pipes, more convenient to fix, and proportionately stronger. There is less liability of clogging in the tubes, and the boiler efficiency is greater.

Hot-air systems supply a current of air from heating-tubes in a furnace, in much the same way as the hot water is supplied in the above systems. The air is set free into the room to be warmed, and if not too warm the effect may be agreeable. But the most pleasant warmth is experienced by radiation, and not by actual contact with a warm atmosphere. Also air currents behave in a way that has not yet been fully explained, frequently confining themselves to a small portion of a room without spreading out so as to affect the whole. In fact, the practical difficulties attached to hot-air systems of heating have not yet been overcome.

Heaton Process. A process, also known as the *nitrate* process, for the production of steel from "pig-iron." This is effected by the oxidation of the carbon, sulphur, and phosphorus and of the iron by means of sodium nitrate, and is carried out as follows: The iron is melted in a cupola, and the molten metal is poured into a cylindrical wrought-iron vessel, lined with fireclay—the *converter*. The bottom of the converter contains a charge of nitrate of soda, iron ore, sand, and oxides of manganese, and is covered by an iron grating to prevent the mass from rising to the surface of the melted iron. A vigorous action takes place, and large quantities of fumes escape from the top of the converter, the action being completed in about ten minutes. The bottom of the converter is movable, so that the mass of "crude steel" can be removed, and afterwards reheated, hammered, and rolled into bars.

Heaven. The Hebrew word (*Shamiam*) translated in the Bible "heaven" or "heavens," had in the first instance a physical meaning, but it was also used to denote the abode of God, the region of ineffable light and glory, from which He views and controls the universe. The Christian revelation imparted a fuller conception of the nature of Heaven. In the New Testament it is used in a twofold sense: it is (1) the *place* whither Christ has ascended, and where He makes intercession for mankind, where saints and angels adore the Almighty, and where the redeemed will at last enter into the joy of the Divine Presence; (2) the *condition* of those who have been justified and

raised to a state of grace by the blood of Christ, and who even in this life are made partakers of the joys of Heaven, through their consciousness of union with Him. The belief in a region where the gods dwell, apart from human care and pain, forms an essential part of most Pagan religions.

Heavystone, a mineral known also as *tungsten* or scheelite, and consisting of the tungstate of calcium, CaWO_4 . It varies in colour from white to orange yellow, has a hardness of 5, the high specific gravity of 6. It occurs in a number of localities, but only in small quantities, and is frequently found associated with tin ores, amongst which it was formerly classified.

Hebe, the goddess of youth, or in Latin mythology, Juventas, was the daughter of Zeus and Hera. In Homer and Hesiod she is a virgin, until the deification of Héracles (Hercules), but in later writers, such as Apollodorus, she is the mother of his two sons, Alexiarus and Anticetus. In the *Iliad* she is represented as cupbearer to the gods, and she was worshipped as such at Sicyon and Phlius. At Athens she had an altar near that of Héracles; while at Rome there were two temples to Juventas. She was supposed to have the power of restoring youth.

Heber, REGINALD (1783-1826), an English divine and poet, was born at Malpas, Cheshire, and educated at Brasenose College, Oxford, where he gained the Newdigate prize with his *Palestine* in 1803. He became fellow of All Souls' next year, and was Bampton Lecturer in 1817. After holding the benefice of Hodnet in Shropshire for several years, he was appointed Bishop of Calcutta in 1823, but died of apoplexy after three years. Besides contributing to the *Quarterly Review*, he edited the works of Jeremy Taylor, and wrote some of the best hymns in the *Ancient and Modern* collection. One of the finest of them is "Holy, Holy, Holy," and the most popular, "From Greenland's icy mountains." Heber's half-brother RICHARD (1773-1833) was a great book-collector.

Hébert, JACQUES RENÉ (1757-94), one of the most influential of the extreme revolutionists, was born at Alençon, where his father was a goldsmith. Before the Revolution he was employed at the box-office of the Variétés théâtre, but in 1790 he established his infamous journal *Le Père Duchene*. It has not been proved that Hébert took part in the September massacres, but his journal always strongly advocated proscription. On September 22nd, 1792, he became the deputy of Chaumette, procureur of the Commune (q.v.). With the help of the Cordeliers Club and the Sections, the Hébertists were able to overthrow the Girondins (q.v.), by whose committee of twelve Hébert had been for a short time put under arrest; but they incurred the dislike of Robespierre by their atheistic principles and their influence with the sansculottes, and, having indiscreetly talked of insurrection, they were speedily tried, condemned, and guillotined in the spring of 1794.

Hebrew Language. [SEMITIC LANGUAGES.]

Hebews, EPISTLE TO THE. The canonical authority of the Epistle, implicitly acknowledged in the references of Clemens Romanus (A.D. 70 or 95), does not seem to have been called in question till the middle of the 2nd century. From that time to the end of the 4th century it was rejected by the Roman and North African churches, which regarded it as the work of Barnabas. It was always accepted by the Greek and Eastern Churches, and, owing to the arguments of Jerome and Augustine, it was restored to the canon in the west by the 3rd Council of Carthage (397) and a decretal of Pope Innocent (416). The question of its authorship has furnished a more enduring ground for controversy. The early churches, excepting the North African, regarded it as the work of St. Paul. The Alexandrian fathers introduced the view that it was originally written or at least inspired by St. Paul, and afterwards transcribed from his dictation, or translated from Hebrew into Greek by St. Luke, and this became the general opinion of the Church. Luther, however, maintained that it was written by Apollos, and, among more recent authorities, Neander ascribes it to some unknown member of the Pauline school, and Ewald to a Jewish teacher, resident at Jerusalem. It is doubtful whether it was addressed to the native Jews of Jerusalem or Palestine alone, or to Jewish believers throughout the world; internal evidence rather favours the former view. The allusions to the Temple services show that it was written before the destruction of Jerusalem (70), and the best biblical scholars assign it to the year 63. Against the view that the Greek version is a translation from the Hebrew, Bleek maintains that the purity of the language, the character of the idioms, and the quotations from the Septuagint, show it to be an original composition.

Hebrides, THE, a name given to all the islands on the west coast of Scotland. In the group was anciently included the Isle of Man; and the title "Sodor and Man" perpetuates the memory of the connection, "Sodorensis" (*insulae*) being a Latinised form of the Scandinavian name of the Hebrides, "Sudreyjar." The Hebrides are divided into two groups, the Outer Hebrides, the chief islands of which are Lewis, North and South Uist, Barra, and Benbecula; and the Inner Hebrides, composed of Skye, Mull, Jura, Islay, Rum, Coll, Tiree, Eigg, Iona, Ulva, Colonsay, and other smaller islands—in all making some five hundred. Bute and Arran are also generally reckoned among them. There is some land under cultivation, but a large part of the soil consists of poor pasture, morass, and peat-moss. Gaelic is spoken by the common people, who are usually very small farmers ("crofters"). The climate is mild but damp. For political purposes the Hebrides are merged in the counties of Ross, Inverness, Argyll, and Bute. Among the descriptions of the islands is Dr. Johnson's *Journey to the Hebrides*.

Hebron, of which the modern name is EL KHALIL, is 21 miles S.S.W. of Jerusalem, in the valley of Eskol. It was at first known as Kirjath-arba. Here David reigned for seven years as King of Judah. The mosque "El Haram" is built

on the supposed site of the cave where Abraham and his descendants were buried, and replaces the church built by the Empress Helena.

Hecatæus (HEKATAIOS) of **Miletus**, "the logographer," an early Greek writer, died probably about 476 B.C. Some time before the Ionian revolt, against which he in vain remonstrated, he travelled in Egypt, and throughout the Persian Empire. He embodied the results in two works, the *Periègesis* and the *Historie*. The former was a description of Europe, Asia Minor, Egypt, and Libya ; the latter, an account in the form of genealogies (hence its alternative title *Genealogia*), of Greek fables and traditions. Herodotus made much use of these works, but controverted some of their statements. The fragments, which remain, have been collected and edited by Creuzer, Klausen, and C. and T. Müller.

Hecate, a goddess about whom there are many varying traditions. By some writers she is called a daughter of Persæus, by others of Zeus, by others again of Leto. She is not mentioned in Homer. According to Hesiod and Apollodorus she was a Thracian divinity who assisted the gods in their war with the giants and had power over all departments of life and things. She was confounded with Demeter, Artemis, Persephone, and other deities, and was worshipped especially in Ægina, Samothrace, and Argos. Small statues of her (*Hecatæa*) were numerous also in Athens, and stood before houses or at cross roads, and were consulted as oracles. In later times, from her confusion with Persephone, Hecate came to be regarded almost exclusively as a goddess of the nether world.

Hecatomb (Greek *hekatombs*, from *hekaton*, a hundred, and *bous*, an ox), literally an "offering of a hundred bulls," but used generally of any sacrifice to the gods in which a large number of animals was slain. Hecatombs are frequently mentioned by Homer, and at Athens they gave its name to the month in which they were offered.

Hecker, FRIEDRICH KARL FRANZ (1811-81), a German revolutionary leader, was born in Baden, and for several years practised as an advocate at Mannheim. Some years previously to the revolution of 1848 he plunged into politics and became a Socialist chief. Having failed to attain his ends by constitutional measures, he headed a body of men who invaded Baden, and were defeated at Kandern. He now fled from the Fatherland, and passed the rest of his life in the United States. Here he took part in the Civil War, and died at St. Louis.

Hæla, a volcano in Iceland, 68 miles E. of Reykjavik. It is 5,102 feet above the level of the sea, and has five craters. Of the eighteen eruptions which have taken place during the last ten centuries most have been very violent, and that which began in September, 1845, continued for more than a year. On this and other occasions fine dust in large quantities has been scattered to a very great distance.

Hecla Powder, an American explosive, the basis of which is nitroglycerine, its composition being very similar to that of Hercules powder (q.v.).

Hectare is a French unit of measurement of area. It is equivalent to 100 acres, or about 2·47 English imperial acres. It is usual to express quantities of land in hectares, the acre being rather too small for the purpose.

Hector, the Trojan leader, was the eldest son of Priam and Hecuba. According to Lucian, he slew Protesilaus, the first Greek who landed on Trojan territory. In the *Iliad* he challenges Menelaus ; reproaches Paris with cowardice ; takes leave of his wife Andromache and her child at the Scæan gate ; is wounded in a fight with Ajax Telamonios, with whom he exchanges presents ; afterwards repels an attack by him, and is cured of a wound by Apollo ; slays Patroclus and takes his armour ; is forbidden to fight with Achilles, by Apollo, and protected by him in the first combat ; and on another occasion is chased three times round the city by him. Finally, aided by Athena, Achilles revenges the death of Patroclus on his slayer, and, tying Hector's body to his chariot wheels, drags it into the Greek camp, but it is given up to Priam at the command of Zeus.

Hecuba (HEKABE), daughter of Dymas, and second wife of Priam, King of Troy. In the tragedy of Euripides which bears her name, Hecuba was carried away as a slave by the Greeks to Chersonesus, where her daughter Polyxena was sacrificed before her eyes, and she tore out the eyes of Polymestor, who had murdered her son Polydorus. Another account makes her leap in despair into the Hellespont. Ovid describes her as being metamorphosed into a dog, which went about Thrace howling.

Hedge, a fence formed of living bushes or small trees planted close together and used in agriculture and gardening, both as a means of protection and as a method of decoration. In some countries hedges are in general use ; in others—e.g. France, Germany, and America—they are almost unknown. They are probably commoner in Great Britain, especially England, than in any other part of the world. Before the 17th century, however, they were not much used in agriculture, for under the old system of tillage, called the "three-field system," a "township" was divided into three strips, one of which lay fallow, while in each of the others a different crop was grown, and the land assigned to each individual consisted of plots distributed indiscriminately among the three strips ; these small plots were separated only by balks, and it was not till the common-fields gave way to the practice of enclosing land that hedges became common. A very interesting summary of the advantages of "quicksettyng, dychyng, and hedgyng," is given in Fitzherbert's *Book of Surveying* (1539). In England hedges are usually made of hawthorn, excepting in lofty and exposed situations, where the elder and mountain ash thrive better. These afford the required shelter, but are less serviceable as a means of repelling intruders.

The other plants used include the beech, crab-apple, and blackthorn; while ornamental hedges are made of holly, yew, privet, arbor vitæ, barberry, etc.

Hedgehog, any species of the genus *Erinaceus*, the type of the Old World Insectivorous family *Erinaceidæ*. In this family the zygomatic arch is complete, the small bones (the tibia and fibula) of the hind limbs are united, and the back is clothed with hairs more or less mixed with spines. The common hedgehog (*E. erinaceus*), about 10 inches long, is British, and, like the other thirteen species, has the power of rolling itself up in a ball, so as to present only the spiny armour of the back to a foe. The legs are so short that the belly nearly touches the ground as the animal moves; the spines are dirty-white, ringed with black, the coarse hair yellowish-white, and the sharply-pointed nose black. The species are nocturnal, and feed on insects, molluscs, frogs, toads, snakes, and vipers. The common hedgehog is sometimes kept to clear houses of cockroaches. The only other genus, *Gymnura*, has a single species (*G. rafinesei*), a shrew-like animal, some 26 inches long, 12 of which comprise the tail. It is a native of the Eastern Archipelago, and has a few bristles mixed with the softer hairs, but it cannot roll itself up into a ball.

Hedgehog Transformer, in electrical engineering, a special kind of transformer for the conversion of an alternating current of low potential and high current strength into one of high potential and low current strength, or *vice versa*. [TRANSFORMER.] The important characteristic of this transformer is that its soft iron core does not form a closed circuit; its ends are free, and the magnetic circuit is continued through air from the one pole to the other. It seems to be shown practically that such open circuit transformers are not so efficient in their conversion of electrical energy from one potential to another, as closed circuit instruments; the reason is as yet unknown.

Hedge Sparrow (*Accentor modularis*), a common British bird. The adult male is about 6 inches long, and the female somewhat smaller; the general plumage is a dusky reddish-brown. They feed on insects, larvæ, and seeds. [ACCENTOR.]

Heem, JAN DAVIDSZ VAN, a great Dutch painter, son of David van Heem, a flower-painter, was born at Utrecht at the beginning of the 17th century, and died at Antwerp between 1675 and 1685. Examples of his work are to be found in many Continental galleries.

Heeren, ARNOLD HERMANN LUDWIG (1760-1842), an able German historian, was born near Bremen, and educated at Göttingen, where he subsequently became professor of philosophy and of history (1801). His chief works were *Historical Researches into the Politics, Intercourse (Verkehr) and Trade of the Chief Nations of Antiquity*, published in 1793-96, and translated into English in 1833, and *History of the Political System of Europe*, published in 1800, and translated in 1833.

Hefele, KARL JOSEPH VON, a Catholic theologian, was born in 1809; his chief works are *Patrum Apostolorum Opera* and *Konziliengeschichte*.

Hegel, GEORG WILHELM FRIEDRICH (1770-1831), a German idealist philosopher, was born at Stuttgart. While studying at Tübingen he saw much of Schelling, by whom he was greatly influenced. After having been some years tutor in a family, he, in 1801, came to Jena, where he was *privat-docent* and professor-extraordinary. During these years he conducted with Schelling a philosophical journal, but his *Phänomenologie des Geistes*, published in 1807, showed a divergence from the views of that thinker, as well as from those of Kant and Fichte. When the university was broken up in consequence of the French invasion, Hegel was for a short time a newspaper editor at Bamberg, and then passed nine years as director of the Nuremberg Gymnasium. In 1816, after the publication of his *Logik*, he was made professor at Heidelberg, which he left two years later for Berlin, where for the rest of his life he held the chair of philosophy. He was married in 1811, and died of cholera twenty years later. As an example of his power of concentration, the story may be mentioned that he was in Jena on the night of the great battle completing one of his works, and knew nothing of what had occurred till the next morning. His chief works were his *Wissenschaft der Logik* (1812-16), his *Encyclopädie der Philosophischen Wissenschaften* (1817-27), and the *Philosophie des Rechts* (1821). Besides these, in the collected edition, published by his pupils after his death, were contained his lectures on the *Philosophy of Religion, Art, and History*. Hegel's philosophy may roughly be described as a very elaborate form of Pantheism or Monism. Its leading characteristic is perhaps its insistence on the idea of continuous progressive development in thought and things (a progress which perpetually involves the passage of a thing into its opposite and the subsumption of the two under a higher unity, including both), on the essential oneness of thought and things, and on the doctrine that the progress of each individual repeats that of the race and the world. All these notions have been independently developed by evolutionist thinkers, especially in biological science. "The real is rational and the rational is real," was his main doctrine. Hegel's lectures exercised an enormous influence upon the German thought of his day, and an order of the Prussian Government gave his doctrines official recognition as the authorised philosophy of the universities. But after his death his disciples began to be divided in their interpretation of his system.

Hegesippus, an early Christian writer, who lived probably in the 2nd century. Very little is known of his life, but he is said to have been a Jewish convert; and he says of himself that he made a journey to Rome, and compiled a list of the Bishops of Rome from 156 to 167. His *Five Memorials of Ecclesiastical Affairs* is quoted by Eusebius, and exists only in fragments.

Hegira, or HEJRA (Arabic), the "emigration" of Mohammed (q.v.) from Mecca to Medina in 622 A.D., which, 17 years later, was made by the Kalif Omar the starting-point of the Mohammedan calendar. The new era began with the first new moon in the month Moharrem, which is generally supposed to have fallen on July 16th, but, according to Caussin de Perceval, the true date is April 19th. The Mohammedan era is reckoned by lunar years of 354 and 355 days.

Heidelberg, a town in Baden, near the left bank of the Neckar, 54 miles S. of Frankfort-on-the-Main, is situated in beautiful country at the foot of the hill called the Königsthul ("King's-seat"). Above the town, at the height of 300 feet, are the ruins of a castle whose foundations were laid in the 13th century. Here the Electors-Palatine resided from the 12th century till 1802; in its cellar is the Heidelberg Tun, which once held 50,000 gallons of wine. Among the buildings of Heidelberg the most notable are the church of the Holy Ghost (late Gothic) and the church of St. Peter, to which Jerome of Prague nailed his theses. The university, founded by the Elector Rupert I., in 1386, is one of the most famous of German seats of learning. There are upwards of 100 professors and lecturers, and nearly 1,000 students. It has a fine collection of MSS. and 500,000 books. Among those who have held chairs at this university are Reuchlin, Puffendorf, Gervinus, Kuno Fischer, Helmholz, and Bunsen. Heidelberg, as a centre of Calvinism, suffered much in the Thirty Years' War; and its castle was almost destroyed by the French forty years later. Books and wine are the chief objects of trade.

Heights, DETERMINATION OF. This may be effected by calculation from data supplied by ordinary surveying instruments, the necessary formulae being supplied by trigonometry. Also it may be obtained by careful measurement of the barometric pressure at the unknown height, if at the same time the pressure at another known level in the vicinity be observed. This barometric pressure is usually in accurate work taken with a mercurial barometer. Such as are employed for the determination of the heights of mountains are specially constructed to admit of transport without danger of fracture. Aneroid barometers (q.v.) may also be used; they are far more portable and less liable to damage, but they are less accurate, and to get satisfactory readings it is necessary to have closely studied the behaviour of the special instrument employed under various conditions of pressure and temperature. Scales of height are often attached, but theory requires that a separate scale should be used for every value of barometric pressure at sea-level. Hence the results of using such a scale are only approximately correct, perhaps strictly so in the one case where zero-level pressure is 31 inches of mercury. A third way of determining the pressure, and of therefore estimating the height, is by observation of the boiling-point of water. The temperature at which this takes place is 212° F. at a pressure of 30 inches of mercury; but as this temperature becomes

lower when the pressure is lowered, and as the relation between the pressure and the boiling-point is accurately known the above object may be readily obtained. A portable piece of apparatus for supporting a sensitive thermometer in the vapour proceeding from boiling water is constructed for height-measurements and is known as the *hypsometer*.

Heilbronn, a town in Würtemberg, 28 miles N. of Stuttgart, stands on the right bank of the Neckar. It is a very old place, and the streets have still a mediæval air about them. In 1360 it became an Imperial town, and after much suffering in war, fell to Würtemberg in 1802. The chief objects of interest in it are the church of St. Kilian, the town-hall, and the "Thief's Tower" (Diebsturm), in which Götz von Berlichingen was imprisoned; what is now a barrack was formerly the hall of the Teutonic Knights. Silver-plate, chemicals, and paper are made here; and a large grocery trade is carried on. There are also fairs in which cattle, fruit, wool, and leather are sold.

Heine, JOHANN HEINRICH (1799-1856), the greatest of German writers after Goethe, was born at Düsseldorf, of Jewish parents. Here he went to school and struggled with Greek and Latin grammar, and gazed with admiration upon the soldiers of his hero Napoleon. After making trial, in deference to the wishes of his relatives, of his fitness for a commercial career at Frankfort and in Hamburg, and falling in love with his cousin at the latter place, he was sent by his rich uncle Solomon to the university of Bonn, on condition of his adopting the legal profession. He studied law, indeed, and actually took a degree at Göttingen in 1825, but he gave more attention to the lectures of Schlegel. From 1821 to 1825 he was at Berlin, where he heard Hegel lecture, and made the acquaintance of Rahel, wife of Varnhagen von Ense. Here also he published his first poems and two tragedies. Before taking his degree he had to qualify for the legal profession by being baptised, although he had no more belief in Christianity than he had in Judaism. The next few years saw his best work done, as the first half of the *Reisebilder*, his prose masterpiece, appeared in 1826-27, and the *Buch der Lieder* in the latter year. The next few years of Heine's life were passed chiefly in Munich in journalistic work, some of which, as the *Französische Zustände*, has been republished. The expression of his revolutionary sympathies brought on him the displeasure of the Prussian Government, and in 1831 he took up his abode in Paris. Here he lived for the rest of his life, but paid short visits to Germany, notably, that of 1844, of which *Deutschland* was the outcome. In 1836 he republished a criticism upon the subjects of his early admiration, *Die Romantische Schule*, and though still full of revolutionary ardour, was impelled by an intense hatred of its German advocates to write a fierce attack on Ludwig Börne in 1840. This brought upon him a duel with Börne's widow's husband. He had already been engaged in a hostile encounter on account of Mathilde Mirat, a Paris *grisette*, whom he had

married after living with her for four years. Enjoying the best literary society of Paris in spite of his Bohemian proclivities, his days were happy until his health, which had never been robust, finally broke down in 1848, when a spinal disease confined him to his bed for the rest of life. Meanwhile, he had published between 1835 and 1840 the miscellaneous writings contained in *Der Salm*, and *Atta Trull*, a poem (1846). During his years of suffering his intellect remained unimpaired, and the *Neueste Gedichte* and *Romanzero* showed something like a return to his earliest and best work. He was buried at Montmartre in the land of his adoption. Heine has been called the Voltaire of Germany; but while he had to the full the French feeling for style, he had depths of sensibility to which no Frenchman, except perhaps Hugo, ever penetrated. His poems have been translated by Bowring, Lord Lytton, Sir Theodore Martin, J. Geikie, and many others; his entire works by C. G. Leland. There are English lives by W. Sharp and Stigand; and the essays on Heine by Matthew Arnold and George Eliot (the latter little known) are both appreciative and suggestive.

Heineccius, JOHANN GOTTLIEB (1681-1741), a learned German jurist, was professor of philosophy at Halle from 1713 to 1720, and twice held the united chairs of law and philosophy at that university (1720-23 and 1733-41), besides occupying similar posts at other universities. He wrote upon philosophical principles the following, amongst other works: *Historia Juris Civilis Romani* (1733), *Elementa Juris Germanici* (1735), and *Elementa Juris Nature et Gentium* (1723), the last of which was translated into English. His brother, JOHANN MICHAELIS (1674-1722), was author of a work on ancient German seals.

Heir, Heiress, the person to whom the inheritance of lands descends according to a certain prescribed order of descent, and he is either "heir-apparent" or "heir-presumptive." An heir-apparent is one who will be heir to his ancestor if he survive him. He is not heir in the proper sense of the word until after the death of his ancestor, for "*nemo est hæres viventis*." Formerly the term "heir-apparent" was applied to the nearest living heir, for he would be heir if the ancestor died immediately, while no distinction was made between an "heir-apparent," who must be heir in any event, and an heir-apparent whose claim is liable to be defeated wholly or partially by the birth of a nearer heir or coheir. At the present day, however, "heir-apparent" means one who, if he survive the ancestor, must certainly be his heir—*e.g.* an eldest son in ordinary cases; while any other heir is called an heir-presumptive, because his claim to inherit is liable to be defeated by the birth of a nearer heir. An heir ("apparent" or "presumptive") according to the above distinction, then, is the nearest blood relation capable of inheriting to his ancestor. The term "heir" is also used as a word of limitation to denote the quality of an estate of inheritance on its creation. This was formerly imperative, but by the "Conveyancing Act, 1881," the word "heirs" or "heirs of my body" are no longer necessary to create

an estate in fee-simple or fee-tail, and by the "Wills Act" it is enacted that where any real estate shall, after the passing of that Act, be devised without words of limitation, it shall be construed to pass the whole interest which the testator had power to dispose of, unless a contrary intention should appear by the will. An *heir-at-law* or *heir-general* is one who by the common law succeeds to the lands and tenements of his father or ancestor at his death. [DESCENT. WILL.]

Heirlooms are such goods and personal chattels as, contrary to the nature of chattels in general, go by special custom to the heir or devisee of the owner along with the inheritance, and not to his executor. The owner of an heirloom cannot dispose of it by will, so as to sever it from the inheritance, though he may dispose of it during his lifetime.

Hel, the Scandinavian goddess of the lower regions, was the daughter of Loki and Angurboda. The darkness of her aspect betokened the fierceness of her character. All who died of old age or sickness were the victims of her cruelty and her greed.

Helder, THE, a port of Holland, 51 miles N.W. of Amsterdam. Situated at the northern end of the North Holland Canal, it has a good harbour, and is a strong fortress as well as a port. There is an arsenal and a naval training-college, and also a meteorological institute.

Helen, the beautiful woman whose abduction by Paris was the cause of the fall of Troy. Her father was said to be Zcus, who visited her mother Leda in the form of a swan. Her great beauty caused her to be carried off in her youth to Attica by Theseus and Peirithous; but she was rescued by her half-brothers Castor and Polydeuces, or Pollux, and afterwards given in marriage to Menelaus. From him Paris, with the help of Aphrodite, carried her off to Troy. Then Menelaus got together a mighty host of Achæans, some of whose leaders had been Helen's suitors, and after a ten years' siege Troy was taken. There are various accounts of what happened to her later. One makes her marry Diœphobus, the brother of Paris, and betray him to Menelaus, with whom she returns to Sparta. In another she marries Achilles. In a third she is driven from Greece and flies to Rhodes, where she is strangled by Polyxo. In two plays of Euripides she is an important character. In the *Troades* she uses all the arts of apology to win back Menelaus. Another myth, alluded to by Stesichorus and Herodotus, related that only a phantom Helen went to Troy, the real Helen being safe in Egypt all the time. The last Greek poet who dealt with the subject was Quintus Smyrnaeus. Virgil, in the *Aeneid*, makes her salvation from the wrath of Eneas in the temple of Vesta come from Venus.

Helena, the largest town in Montana, is in the Prickly Pear Valley between the Rocky Mountains and the Missouri river. Until lately it was only a collection of gold-diggers' log-cabins, and was called Last Chance Gulch. The seat of the State

government, it has Government offices and several other buildings, and is an important railway centre.

Helena, the EMPRESS, mother of Constantine, became a Christian after the defeat of Maxentius. Iraclibim says she visited Jerusalem in 326 and discovered the Holy Sepulchre and the three crosses. She was canonised after death, her festival being August 8th. There is a saint in the Greek Church of the same name, who lived in the 10th century, and was of noble birth.

Helianthaster, an extinct genus of starfish, occurring in the Devonian rocks, and especially in some slates that are in Germany.

Helicon, a range of mountains in Boeotia, ancient Greece, were the fabled abode of the Muses. From them sprung the founts of Aganippe and Hippocrene, draughts from which gave inspiration. The village of Asgra at the foot of the mountains was the home of Hesiod.

Helicopter, a species of flying machine which, instead of possessing large sustaining surfaces, as in monoplanes and biplanes (AEROPLANE), has a number of revolving fans which serve the double purpose of sustaining the machine and effecting progression. Although no practical achievement has yet been accomplished by this class of flying machine, Edison believes that when perfected it will enable an aviator to "encircle the globe in a week." [AERONAUTICS.]

Heligoland, a small island in the North Sea, some 35 miles from the mouth of the river Elbe. It is about a mile long and a third of a mile broad. The greater part of the houses are on a rock 200 feet high. Bathing in the season takes place from Sandy Island or Düne, a sandbank about a mile distant. A great deal of fishing is carried on. Heligoland was taken from the Danes in 1807, and ceded to England by the treaty of 1814. By an agreement in 1890 it was given up to Germany in exchange for certain concessions in East Africa, and it has been strongly fortified. An action was fought off Heligoland on May 9, 1864, between two Austrian frigates and three Prussian gunboats under Commodore Tegethoff, and three Danish frigates under Commodore Svensen. The allies got the worst of it.

Heliocentric, in astronomy, is a term expressing a reference to the sun as the central body from which distances, etc., are measured. Such reference is often more convenient than the *geocentric*, which regards the earth as the standard position for measurement.

Heliodorus, a Greek writer of the third century, was born at Emesa. He wrote a romance of some literary power called *Aethiopica*, the subject of which was the loves of Theagenes and Chariclea, which has been edited by Bekker and Heischig.

Heliogabalus, or ELAGABALUS, Emperor of Rome, was one of the worst who wore the purple. He derived his name from the sun-god Elagabal, whose high priest at Emesa he was, but on the

death of Caracalla was set up by the soldiers against Macrinus, and upon the defeat of the latter in 218 became emperor. After a reign stained by every kind of cruelty and folly the pretorians rose against him and murdered him in 222.

Heliograph, or HELIOSTAT, is an instrument for flashing messages from one point to another by means of sunlight reflected from a mirror. Its chief applications have been to military tactics. Signalling has been effected through a distance of 190 miles in California and 170 miles in Algeria.

Helicites. [HELIOPORIDE.]

Heliometer, an instrument due originally to Savery and Bouguer, and improved a century later by Dollond and Fraunhofer, its purpose being to measure the angular diameter of the sun, or any other heavenly body with an appreciable disc, or the angular distance between any two bodies near each other. One form consists of an object-glass cut into halves; each half gives a separate image of the heavenly body, but as the halves are made to slide apart the images draw nearer to each other and ultimately coincide. The distance apart of the two halves measures the required angular distance.

Heliopolis, "the City of the Sun," called by the Egyptians On, was situated on the most eastern branch of the Nile near Pelusium. It was the chief of the sacred cities of Egypt. To it Solon and Plato are said to have resorted, and among the chief priests were Manetho and Potiphar. Near it is still to be seen an obelisk called Pharaoh's Needle, and Cleopatra's Needle was also originally here. This place is not to be confounded with Baalbec or Syrian Heliopolis.

Helioporidae, a family of Alcyonarian (q.v.) corals popularly known as the "Blue Corals" from their fine azure blue colour. The skeleton is calcareous, and is formed of a series of tubes of two sizes. Each set are inhabited by polypes of different structure, so that the colony is dimorphic. The larger tubes especially are crossed by tabulae or horizontal plates, and have septal plates running along them. The latter are usually twelve in number in each tube, and have no relation to the mesenteries. They are really foldings of the walls, and are known as pseudo-septa. The smaller or "cenenchymal" tubes contain rudimentary sexless polypes. The only genus in the family is *Heliolites*, which forms round lobed masses. It lives in the Indian and Pacific Oceans. The Silurian genera *Heliolites*, *Plasmopora*, etc., are probably also members of this family. They are tabulate, and consist in the same way of masses of large and small cenenchymal tubes.

Helios, the Sun, was worshipped by the Greeks as a god. Homer makes him the son of Hyperion and Theia, and the brother of Selene, the Moon. He rises from Oceanus in the morning to give light to gods and men, and falls into it again in the evening. Later writers placed his residence at Colchis, whither he was conveyed back after the toils of the day in a golden flying boat. Helios

afterwards became almost identical with Phoebus in the minds of poets. Rhodes was the chief seat of his worship, and Sicily (Trinacria) was also sacred to him. White lambs and boars were offered to him.

Helioscope, a telescope with darkened glass, through which the sun may be observed without injury to the eyes.

Heliotrope. [BLOODSTONE.]

Heliotrope, HELIOTROPIUM, a genus of small plants belonging to a tribe closely related to the Boragineæ. They are hairy; have scattered leaves, small lilac, blue or white flowers in scorpioid spikes, with the polysymmetric pentamerous calyx, corolla and stamens and two deeply-divided carpels characteristic of the borage family. They are natives of the tropical and sub-tropical regions of both hemispheres, some occurring in Europe, and 23 species in Australia, whilst the favourite "cherry-pie" of our gardens is *H. peruviana*.

Heliotropism, in vegetable physiology, is the response of the plant to the directive influence of light. Light has in general a retarding influence upon growth, so that illuminated parts grow more slowly than those in shadow. From the unequal growth thus caused curvature results, which is more marked when the light is more intense. The effect is produced mainly by light between the violet and ultra-violet of the spectrum, but even the dark ultra-red rays have some effect. Among radially symmetrical organs, such as axes, stems are generally *positively heliotropic*—bending, that is, towards the light, as seen in plants growing in a window, owing to the more rapid growth on the shaded side—while roots are mostly *negatively heliotropic*. A reversal of direction in one organ is exemplified in the flower-stalks of *Linaria Cymbalaria*, the ivy-leaved toad-flax, which in the flower stage is positively heliotropic and so droops, and in fruit becomes negatively so and erect. Vertical or bilateral organs, such as the leaves of *Iris*, are positively heliotropic. Dorsiventral organs, such as most leaves, exhibit what is termed *dia-heliotropism*, placing their dorsal surfaces at right angles to the direction of incidence of the light.

Heliozoa, a class of Rhizopoda (q.v.) which have stable pseudopodia which rarely branch or anastomose. They possess a contractile vacuole (q.v.), but no central capsule separating the external from the internal portion of the protoplasm. They resemble the Radiolaria (q.v.) in the first character, and also in the occasional presence of siliceous spicules. The absence, however, of a central capsule shows that they are simpler in organisation than these. The majority are inhabitants of fresh water. The best-known type is *Actinophrys sol*, a common fresh-water organism less than a thousandth of an inch in diameter. The shell is the main character used in classification. There are four groups: the Aphrothoraca, without any skeleton, e.g. *Actinosperium*, the Chlamydophora, with a loose gelatinous skeleton, the Chalarothoraca, with a skeleton of loose siliceous spicules, e.g.

Acanthocystis, and finally the Desmothoraca, with a globular siliceous shell pierced by apertures, e.g. *Orbulinella*.

Helix, the type genus of the *Helicidae*. [SNAIL.]

Helix, or SPIRAL, is a curve of much interest in mathematics. It is traced out by a moving point that combines a rotation about an axis with a rectilinear movement in a line parallel to the axis. An ordinary screw-thread affords an example of the regular helix. The amount of onward motion in the direction of the axis that is produced in one complete rotation is called the *pitch*. Thus if a screw of $\frac{1}{4}$ -inch pitch, penetrating a piece of wood, is given one complete revolution it advances $\frac{1}{4}$ inch, and proportionately less for any fraction of a revolution. This uniformity of advance shows that the spiral can be produced by wrapping a triangular slip of paper round a cylinder.

Hell, in the Authorised Version of the New Testament, translates three different words—*Hades*, *Gehenna*, and *Tartarus* (2 Peter ii. 4), which has the same meaning as *Gehenna*. *Hades* is the word used in the Septuagint to render the Hebrew *Sheol*, the gloomy region into which all men pass after death. It was only during the Captivity that the Jews came to distinguish between *Paradise*, the abode of the virtuous, and *Gehenna*, that of the wicked. Much misconception has arisen through the employment of the same word to render *Hades* and *Gehenna*. This was probably due to the anxiety of the translators to avoid the appearance of giving any support to the doctrine of Purgatory. The orthodox Protestant view was that every soul passed immediately on death into a state of everlasting bliss or torment, and it was only with the latter of these that either *Hades* or *Gehenna* could be identified. The materialistic conceptions regarding the future place of punishment which grew up in the early Church, and are by no means extinct at the present time, were based on the words used by Christ in His allusions to *Gehenna*. But there can be no doubt that His language was figurative, and it is now generally agreed among divines, as more consonant with the teaching of Christianity, that the anguish suffered by the wicked after death is of a spiritual rather than a physical character. As regards the larger question of the possibility of salvation after death, the doctrine that there is no intermediate state between those of the redeemed and the damned, and that the judgment once passed on the dead soul is final, is still regarded as the orthodox Protestant view. But it is very doubtful whether this doctrine can be established even by a literal translation of the sacred text, and many eminent Christians have found it extremely repugnant to their moral sense. The words of the Saviour to the crucified robber distinctly point to an intermediate state; and it is by no means certain that *aionios* denotes "eternal" punishment; on etymological grounds, at any rate, it should rather mean "lasting for an age" or "for ages." Origen, in the 3rd century, put forward the doctrine of "Universalism," which teaches that all men will

finally be saved; it was at least regarded with favour by St. Jerome, and in modern times has received the assent of many eminent theologians.

The doctrine that Christ "descended into hell," accepted by the Church in the Creed and in the Third Article of Religion, has been interpreted in several different ways. It is founded mainly on 1 Peter iii. 19 (*cf.* Ephesians iv. 9; Acts ii. 27-31). It was taught by Ignatius, Hermas, and other early Fathers. The general view of the Christian Church on this difficult point is that the "soul" is the spirit or rational part of Christ—that which the Jews could not kill—and that "hell" is the place of departed spirits.

Helladotherium, a genus of extinct ruminants, intermediate between the Cervidae and Bovidae, but, like the giraffe (q.v.), more nearly related to the former. Its remains have been found in the older Pliocene rocks of Pikermi in Attica, of S. France, and of the Siwalik Hills in India.

Hellebore, a name applied by the Greek herbalists to two very different groups of medicinal plants, the "black hellebores," so called from the dark colour of their rhizomes, belonging to the ranunculaceous genus *Helleborus*, and the "white hellebores," belonging to the liliaceous *Veratrum* (q.v.). The species of *Helleborus* are herbs with pedate or palmate radical or caudine leaves; five persistent and often petaloid sepals, generally green, white, or red; the same number of small, deciduous, tubular green petals, serving as nectaries; numerous stamens, arranged spirally; and a circle of carpels slightly united at their bases, and forming follicles in the fruit stage. *H. viridis*, the green hellebore, with yellowish-green sepals, and *H. foetidus*, the stinking hellebore or bear's-foot, with its green sepals splotched with dull red, are natives of England. *H. niger*, the Christmas rose, with dark green foliage and spreading white or pink flowers, is a native of central and southern Europe, now much grown in our gardens. *H. orientalis*, a native of Asia Minor, with a more separable cortex to its woody rhizome, is probably the drug used by the ancients. The hellebores contain the poisonous glucosides *helleborin*, $C_{26}H_{42}O_6$, and *helleborin*, $C_{26}H_{44}O_{15}$. The rhizome of *H. niger* is poisonous, rubefacient, and vesicant when fresh, and emetic, purgative, and sternutatory when first dried, but afterwards losing its purgative property. Death ensues from poisonous doses, as from those of *Digitalis*, from paralysis of the heart. The tincture is used in dropsy; but both this species and *H. foetidus* and *H. viridis* are now chiefly employed in veterinary practice. Greek and Roman writers attributed to "hellebore" an efficacy in cases of insanity.

Helleborin, a body of the class of compounds known as glucosides (q.v.), which occurs in the roots of the Black Hellebore and some other plants. It forms shining white crystals insoluble in water, and possessing a burning taste. It has the composition $C_{26}H_{42}O_6$, while a closely-related substance, Helleborin, of composition $C_{26}H_{44}O_{15}$, also occurs in the same sources.

Helleborine, the English name of plants belonging to the two Orchidaceous genera *Epipactis* and *Cephalanthera*. Three species of the latter and two of the former occur in Britain.

Hellenists. (1) Greeks (Hellenes) or foreigners who became Jewish proselytes. (2) Jewish settlers in foreign lands who adopted the Greek language and the Greek manner of life, then everywhere current, while they clung to Hebrew tradition, and retained the Hebrew cast of mind. The word is translated "Grecians" in the Authorised, and "Grecian Jews" in the Revised Version. The opposition between "Hebrews" and "Hellenists" in the early Church at Jerusalem is mentioned Acts vi. 1; cf. ix. 29. Alexandria was the great commercial centre in which the Hellenistic spirit received its fullest development. Here arose the dialect called Hellenistic Greek, in which Hebrew terms of thought appeared clothed in a Greek dress, thus giving rise to what was practically a new language with its own peculiarities of vocabulary, idiom, and construction. A literary monument of Hellenistic Greek is preserved in the Septuagint version of the Old Testament. The speculations of Hellenistic philosophers such as Philo (q.v.) exercised much influence over Christian thought, and gave rise to many heresies. This application of the term "Hellenism" must not be confused with its use to denote Greek life generally under the monarchies succeeding Alexander the Great, when much of the East and Egypt became predominantly Greek in speech though not in population.

Heller, STEPHEN (1815-88), a brilliant pianist and composer for the pianoforte, was born at Pesth. He went to Augsburg to complete his musical education, where he stayed eight years, and then went to Paris in 1838. Heller composed many études, preludes, tarantellas, and small pieces of great delicacy.

Helm, the apparatus by means of which a ship is steered. It includes, in large ships, the rudder, the tiller, and the wheel, and in small craft the two former only. The term helm is applied more particularly to the tiller; "starboard the helm" means "bring the tiller over to the right side of the ship." To "put the helm down" is to push the tiller to the lee side, so as to put the vessel about, or lay her to the windward.

Helmet. In heraldry, distinctions of rank are denoted by the metal of the helmet, the number of bars in the vizor and the position.

Helmholz, HERMANN LUDWIG FERDINAND VON, a distinguished German physician and scientific writer, born in 1821. He was educated for the medical profession, and practised as a surgeon at Berlin and Potsdam. After having been an assistant in the Berlin Anatomical Museum, he held the chair of physiology at Königsberg, Bonn, and Heidelberg successively, and in 1871 was appointed professor of physics at Berlin. His work in physics and in physiology is equally valuable. To the first belongs his essay on the *Conservation of Energy* (1847), also his analysis of

the spectrum. In physiology he has devoted himself chiefly to physiological optics and the connection between sight and sound. He invented an instrument with which the retina of the living eye can be studied, and wrote *Theory of Sound Sensations* (1862), and *Sensation of Tone as a Physiological Basis for the Theory of Music* (trans. 1875). Besides this he made investigations on the subject of nerve disturbances, vibrations of air in pipes, and the relation between colour and sound. The English translation of his *Popular Scientific Lectures* (*Vorträge*) has an introduction by Tyndall. He died in 1894.

Helmont, JEAN BAPTISTE VAN (1577-1644), a great Belgian chemist, was born at Brussels and educated at Louvain. Before his marriage in 1605 he travelled in England, France, and Switzerland. Four years afterwards he settled down to a life of study at Vilvorde, his estate near Brussels. Throughout his life he wavered between science and mysticism, and was in early life deeply religious, both studying and putting into practice the teaching of the *Imitatio Christi*. This was succeeded by an absorption in Paracelsus and a devotion to alchemy and chemistry. Van Helmont's contributions to the latter were his distinction between various gases, his insistence on the employment of the balance with the demonstration of its consequences, and his investigation of human fluids. He is said to have been the first to employ the term "saturation" and to use boiling-point and melting-point as measures of temperature. Many editions of his works have been printed, and in 1868 a book by Rommelaere, *Etudes sur Van Helmont*, was published at Brussels.

Heloderm, either of the two species of *Heloderma*, from western America. These lizards are the only ones known to be poisonous. Their bite soon kills birds and small mammals, but is rarely fatal to man. The wart-like scales are orange and black.

Héloïse. [ABELARD.]

Helots, the serfs who formed the lowest grade in the Spartan population, consisting originally of the Achaean landowners who had been enslaved by the Doric invaders. In many respects they resembled the mediaeval villeins—e.g. they worked for individual proprietors, to whom they paid a fixed rent in kind, and they could not be sold away from the land to which they were bound. They belonged to the state, which alone could grant them freedom. In war they usually served as light-armed troops, but occasionally they were enrolled as a part of the regular army. They were very cruelly treated, and the murder of Helots was one of the duties entrusted to the "secret commissions" of Spartan youths.

Helps, SIR ARTHUR (1817-75), a popular essayist, was born at Streatham. After having been private secretary to Mr. Spring Rice and Lord Morpeth, he was in 1860 appointed clerk to the Privy Council. His *Essays Written during the Intervals of Business* appeared in 1841, and *The Claims of Labour* in 1844. The first series of

Friends in Council, a discussion of various social and literary subjects in the form of a dialogue, was published in 1847, and was succeeded in 1869 by a second series. This author also wrote *The Spanish Conquest of America* (1855-61), and biographical studies in similar subjects, some novels (*Ivan de Biron*, etc.), and some plays of inconsiderable merit. His last book, *Social Pressure*, was published in 1875.

Helsingfors, the capital of Finland, is situated on a peninsula in the Gulf, in lat. 60° 10' N. and long. 25° E. Its founder was Gustavus I. of Sweden, by whom it was placed on a site somewhat farther inland than the present town. In 1819 it became the capital of the duchy. Though it has now for a century been in Russian hands, Swedish is still spoken in the town. Helsingfors is protected by the fortifications of Sveaborg, consisting of a line of batteries a mile long on seven islands at the entrance to the harbour. These were bombarded for two days by the Allies in 1855, and the impression as to their strength was confirmed. Helsingfors is a handsome town, with a senate-house, diet-house, three fine churches, and some university buildings. The university was removed hence from Åbo in 1828, and has upwards of 1,500 students and more than 40 professors. It has a large library, the remains of that which was burnt at Åbo, a hospital, and a good observatory. The town is also important commercially as a Baltic port, and exports large quantities of timber. It is much resorted to by the inhabitants of St. Petersburg as a bathing-place.

Helvellyn, a mountain on the borders of Westmoreland and Cumberland, nearly midway between Keswick and Ambleside, 3,118 feet in height. It is easily climbed.

Helvetia Green, also known as ACID GREEN, a fine green organic dyestuff, derived, like many other colour materials, from triphenyl methane ($C_6H_5)_3CH$.

Helvetii, a Celtic people whose territory—consisting of four "pagi" or cantons—was almost identical with the modern Switzerland, being bounded by the Jura on the west, the Rhine on the north and east, and the Rhone and the Lake of Geneva on the south. Their attempt to subdue Southern Gaul is narrated by Cæsar in his *Gallia War* (bk. i. chaps. 1-29). After burning their towns and villages and collecting supplies sufficient for three months, they assembled at the Lake of Geneva, but Cæsar blocked their way by building a wall along the Rhine, and afterwards defeated them in a great battle at Bibracte, the chief town of the *Ædui* (58 B.C.). The survivors were sent back to their own country, and became subject to the Romans. In the 1st century A.D. they were almost exterminated by one of Vitellius' generals in consequence of their adhesion to Galba.

Helvétius, CLAUDE ADRIEN (1715-71), French philosopher, was born in Paris, and was a son of a doctor who had attended both Louis XIV. and Louis XV. He was trained to be a financier, and from 1738 to 1750, when he resigned, held a

farmer-generalship. His thoughts, however, early turned to philosophy and literature, and even as a boy he was a student of Locke. Though he held the post of chamberlain to the queen, he was but seldom at court, and passed the last twenty years of his life almost entirely at his estate at Voré, in La Perche. He was a popular landlord, and did many kind acts, especially relieving those who had been ruined by the exactions of the farmers-general. As one of the Encyclopædistes he was intimate with Voltaire, Diderot, and D'Alembert, and was fond of getting up what he called an ideal-hunt (*chasse aux idées*) by propounding to a company of his friends some startling paradox. He visited England and Prussia a few years before his death. His chief work was called *De l'Esprit*, and appeared in 1758. Another work, *De l'Homme*, was published a year after his death. Editions of his collected works appeared in 1796 and 1818.

Helvine, or HELVITE, a mineral which forms lustrous regular crystals of a yellow or green colour, specific gravity 3·8, hardness 6. It consists of the silicates of iron, manganese, and beryllium with a sulphide of manganese, and is interesting both as a compound of the rare element beryllium, and as the only known natural compound of a silicate and a sulphide.

Hemans, FELICIA DOROTHEA (1793-1835), a writer of English verse, was the daughter of a Liverpool merchant named George Browne. She was brought up at Gwrych, North Wales, and a quarto volume of her poems was published when she was fourteen. Shelley wished to correspond with her, but her parents refused to allow him, and three years after the publication of her *Domestic Affections* (1812) she married Captain Hemans. They had five children, but in 1818 a separation took place. Next year she published *Translations from Camoëns and other Poets*, which was followed by *The Sceptic* (1820), a prize poem on Dartmoor, *Welsh Melodies* (1822), and *The Vespers of Palermo*, a tragedy produced without success at Covent Garden in 1823. In 1825 appeared *Lays of Many Lands* and *The Forest Sanctuary*, in the second edition of which (1829) *Casabianca* was included. In 1829 she went to Scotland and made the acquaintance of Sir Walter Scott, and in the same year met Wordsworth during a visit to the Lakes. Her last four years were spent in Dublin, where she knew Whately and Blanco White. Her *Hymns for Childhood* were first published in America, where her works were very popular. A memoir of Mrs. Hemans by her sister, Mrs. Hughes, was prefixed to the first collected edition of her works.

Hemelytra, the anterior wings of the Heteroptera (q.v.), so called because half are thickened to form elytra and half remain as membranous flying wings.

Hemianopia, **Hemiopia**, the condition in which the corresponding halves of the two retinas fail to convey the impression of sight to the central nervous system, in consequence of which only one half of an object to which the gaze is directed is

visible. This rare symptom occurs in some cases of tumour within the brain.

Hemicrania. [MEGRIM.]

Hemimetabolic Insects are those in which the metamorphosis is "incomplete"—i.e. the pupa is active, so that the caterpillar and imago stages are not sharply marked off by a resting chrysalis stage.

Hemimorphite, or SMITHSONITE, the mineral hydrous silicate of zinc ($2ZnSiO_4 + H_2O$), a valuable ore of zinc, crystallises in the Prismatic system, often in hemihedral twins of the rhombic prism, with perfect crystalline cleavage, but also occurs massive, granular, fibrous, or stalactitic. It varies from transparency to opacity, from white to yellowish brown, and from adamantine to vitreous or subpearly lustre. Its hardness is 4·5 to 5, its specific gravity 3·16 to 3·5, and it is thermo-electric. Before the blowpipe it is almost infusible, but it turns green with cobalt-nitrate. In the mattrass it decrepitates, whitens, and gives off water. It gelatinises with acids, and dissolves in strong caustic potash. It is found with calamine (q.v.) in the Mendip Hills; at Matlock and Castleton, Derbyshire; Alston Moor, Cumberland; Leadhills, Lanarkshire; Aix-la-Chapelle; Schemnitz in Hungary; and various places in the United States.

Hemiplegia. [PARALYSIS.]

Hemiptera. [RHYNCOPTA.]

Hemlock (*Conium maculatum*), a poisonous biennial plant belonging to the Umbelliferae, is a not uncommon hedge-row plant in the British Isles. It grows from three to five feet high, erect and



HEMLOCK (*Conium maculatum*).

branching, and is most readily recognised by the dark purplish spots on its smooth, hollow stem and its strong, mouse-like smell. The leaves are tri-pinnate, and, in addition to the general involucres, the compound, many-rayed umbels of small white flowers have involucels of three short

bracteoles all on one side, the outer side, of the peduncle. The fruits are broadly ovate, splitting into mericarps, each having five crenate projecting ribs, but no oil-vittæ. These fruits, and, to a less extent, the leaves, contain the poisonous alkaloid *conia*, $C_8H_{15}N$, which is similar in its action to nicotine. Hemlock is chiefly employed as an extract or tincture, acting as a sedative or antispasmodic; but large doses produce giddiness, nausea, and paralysis. Many allied umbelliferous plants are commonly confused with hemlock.

Hemlock-spruce (*Tsuga canadensis*) is a conifer related to the spruces (q.v.), native to the north-east of North America, where it is often called simply the "hemlock." In New Brunswick and Nova Scotia it is often the predominant species. It prefers dry, mountainous woods, and often reaches a girth of nine feet. The wood is crooked in grain and liable to warp, and is not, therefore, of much value. The main branches droop elegantly. The shoots are used for spruce-beer. The leaves are short, flat, light green above and whitish below, resembling those of fir adpressed on the stem, and distichous on the twigs. The cones are small, ovate, and pointed, resembling, but much smaller than, those of the true spruces, *Picea*. The bark is stripped off in May and June, and, either unprepared or as an extract, is largely used in tanning. The tree also yields the slightly stimulant Canada pitch, a substitute for Burgundy pitch.

Hemp (*Cannabis sativa*), an annual plant, which, like the hop (q.v.), belongs to the Cannabinaceæ, a sub-order of the Urticaceæ, and has been employed as a fibre, and as a source of a medicinal and intoxicating resin from very ancient times. The hemp plant is probably a native of temperate Asia, near the Caspian. It is dioecious, the female plant being the larger, and reaching to 10, or even 17 feet in height. The leaves consist of from five to seven lanceolate-acuminate leaflets with serrate margins, arranged palmately. The male flowers are in loose panicles, the female ones in short spikes. Hemp is cultivated in Suffolk and Lincolnshire and in Ireland, but chiefly imported from Russia, Germany, Italy, and the United States, to London, Liverpool, Hull, and Leith. In the official returns various other fibres, such as Manilla hemp (q.v.) from the Philippines, Suna hemp (q.v.) from India, and Pita fibre (q.v.) from Mexico, are included under hemp. Hemp is used for all kinds of cordage, sacking, canvas, and sail-cloth. The preparation of the fibre is similar to that of flax (q.v.). Hemp-seed, which really consists of small nuts or fruits, is used as a food for cage-birds, and contains 34 per cent. of a drying oil, inferior to linseed oil. The oil-cake is purgative. As a drug or intoxicant hemp is used in enormous quantities in the East under the three forms: *bhang*, the dried leaves and twigs, *ganja* or *guaza*, the flowering and fruiting clusters, and *churru*, the exuded resin itself. *Hashish* is a preparation of ganja or bhang with butter. The chemical characters of the resin are imperfectly known. It acts on the nervous system, producing exhilaration and appetite in small doses, hallucinations and even catalepsy in larger ones.

It has been employed as an antispasmodic and anodyne in tetanus and hydrophobia.

Homs, or Homs, a city in Syria, situated on the right bank of the Orontes 63 miles N.E. of Tripoli, is the ancient Emesa, where Aurelian defeated Zenobia, Queen of Palmyra, in 272. The Saracens captured it in the 7th century, and in 1098 it fell into the hands of the Crusaders. The site of the ancient Temple of the Sun is probably that now occupied by the castle. Silk goods and gold wares are made, and a trade in oil and sesame is carried on.

Henbane (*Hyoscyamus niger*), a poisonously annual or biennial plant belonging to the night-shade family, occurs wild on rubbish-heaps and waste ground in Western Asia and Europe, including Great Britain. The biennial form is also cultivated as a drug. The whole plant is covered with viscid hairs, and has a disagreeable smell. The flowers have a persistent campanulate calyx with five lobes, a monosymmetric cream-coloured corolla veined with purple, giving it an unwholesome lurid appearance, and five stamens, and are succeeded by a many-seeded pyxidium (q.v.). The leaves and seeds contain the alkaloid *hyoscyamine* ($C_{18}H_{28}N_2O_3$), which differs from atropine mainly in being more soluble. The extract or tincture is a valuable anodyne.

Hengist ("horse") and **Horsa** ("mare") were, according to Bede and the *Anglo-Saxon Chronicle*, the names of the two leaders of the first Teutonic invaders of Britain. They are said to have landed at Ebbsfleet in 449 or 450 to assist Vortigern, a British prince, against the Picts, and to have received Thanet as the reward of their successes, but afterwards to have turned their arms against him. Horsa was slain at Aylesford in 455, but Hengist and his son afterwards conquered Kent. Their names are not, however, mentioned by Gildas, and it is by no means certain that any such persons existed.

Hengstenberg, ERNEST WILHELM (1802-69), a German theologian of the orthodox school, was born at Fröndenberg, Westphalia. While studying philosophy and Oriental subjects at Bonn, he also took great interest in the Burschenschaft movements. It was at Berlin in 1824 that he first adopted the orthodox position. In 1826 he became extraordinary, and two years later ordinary professor of theology at that university. His reactionary *Evangelische Kirchenzeitung* was begun in 1827. Most of his works have been translated into English, amongst them being *Die Bibler Mosis und Aegypten* (1841), and commentaries on the Psalms, St. John, and the Apocalypse. Hengstenberg opposed the union of the Lutheran and Reformed Churches, and attempted to obtain the removal of Professors Gesenius, De Wette, and other Rationalists and so-called Rationalists from their chairs.

Henley, a town on the Oxfordshire bank of the Thames, 8 miles N.E. of Reading, and 24 miles S.E. of Oxford. The river here is crossed by a bridge with five arches, which was erected in 1786. The

grammar school dates from the early years of the 17th century. Brewing and malting are carried on, and there is a large trade in corn and timber. The first Regatta was held in 1839. Pop. (1901), 5,984.

Henna, the "camphire" of the Bible (Song of Solomon i. 14; iv. 13), is the Levantine shrub *Lavsonia alba*, belonging to the order Lythraceæ, which is also known in England as "Egyptian privet," and in the West Indies, where it has been naturalised, as "Jamaica mignonette." Its older branches become spinous: its leaves are opposite, oval and entire; and its small flowers are in panicles, very fragrant, and have each four petals and eight stamens. The leaves and twigs are pulverised and made into a paste with hot water, and this is used by Mohammedan women from India to Egypt to dye their nails, palms and soles, of an orange-red. The dye was used by the ancient Egyptians, as is shown by their mummies, and is said to have been used by Mohammed for his beard, a custom still followed by men in Persia. The manes of horses are also sometimes stained with it, and it is used in dyeing leather, though not lasting. Its use on the hands and feet is said to check perspiration.

Henrietta Maria, QUEEN OF ENGLAND, was the youngest daughter of Henry IV. of France. She was born in 1609, and in 1625, when the Spanish match had failed, she married Charles I. By the marriage treaty it was agreed that she should be free to exercise her religion. The provision was obnoxious to the English Puritans, and the way in which the privilego was abused caused great trouble to the king. The queen exercised little influence, however, till after the death of Buckingham. She and her coterie are generally thought to have urged Charles to attempt the arrest of the Five Members, and to have finally induced him to sign the Bill of Attainder against Strafford. On the outbreak of the Great Rebellion she took the crown jewels out of the country in order to raise money on them, and on her return shared her husband's fortunes till 1644, when she returned to France, where she lived till the Restoration. She had been impeached by Pym in 1643, but the proceedings were dropped. During the first five years of the reign of Charles II. she resided at Somerset House, the rest of her life being passed in her native France, where she died in 1669.

Henry I., KING OF ENGLAND, youngest son of William I., was born in 1068. He was carefully educated, and attained such a degree of learning as to gain the surname of Beauclerc ("fine scholar"). Henry obtained the crown in 1100, partly by his own promptitude in seizing the royal treasure, but chiefly by the influence of the Earl of Warwick and Anselm. The absence of Robert in Palestine was also in his favour. Before his coronation he swore to maintain peace, to abolish the wrongs committed by the late king, and to deal justice with mercy, and soon afterwards he issued a charter, promising to maintain the privileges of the Church, the vassals, and the people. He then imprisoned Flambard, and invited Anselm back to England. To crown

all, he married Edith, niece of Edgar Etheling, the last of the Saxon line. Robert, on his return from the crusade, claimed the crown, but was satisfied for the time with the Cotentin and a pension. He was too troublesome, however, as a standard round which the forces of feudalism might gather, to be let alone, and, after his defeat at Tenchecbrai in 1106, was deprived of the duchy of Normandy. Henry had to put down four great feudal outbreaks. In 1102 the powerful Robert de Belesme was compelled to surrender his castle at Bridgnorth and to go into banishment. In 1104 another rising took place, and that of 1118 was aided by Louis VI. of France and Count Fulk of Anjou, who made use of the claims of Robert's son William. When the final movement of 1124 had been repressed Henry was at length at peace, and the rest of his years were occupied in administrative reform and the securing of the succession to Matilda, the king's daughter, his son William having been drowned in 1130. At the beginning of the reign the Investiture question had caused a breach between Henry and Anselm, but both had statesmanship enough to agree to a compromise. [ANSELM.] The most important feature of Henry's government was his formation of an official nobility, and the beginning of a regular system of royal justice by the sending round of royal officers to all parts of the country to inquire into abuses as well as to collect taxes; but a disputed succession gave feudal anarchy a last chance and interrupted the work which had been so well begun. Henry I. died in 1135.

Henry II., son of Geoffrey, Count of Anjou, and Matilda or Maud, daughter of Henry I., was born in 1133 at Le Mans. He came to England in his ninth year, but passed the next few years at the Scottish court. In 1151 he became Duke of Normandy and Count of Anjou, and next year, by his marriage with Eleanor, divorced wife of Louis VII. of France, acquired Aquitaine and other territory in the south of France. At the end of the Civil War he returned to England, and by the Treaty of Winchester (1153) was acknowledged heir to the crown, to which he succeeded at the end of 1154. He took up the work of his grandfather, and with the help of Archbishop Theobald and other officials, especially Thomas Becket (q.v.) the chancellor, demolished the baronial castles, reformed the coinage and re-established order under the authority of the Crown. This chiefly occupied the first ten years of the reign: the next eight saw the Becket quarrel, the Assize of Clarendon (1166) and the conquest of Brittany. After the death of Becket Henry went to Ireland, which country was granted him by the Pope in 1172. During the next two years (1173-74) the last great feudal revolt took place. The nobles were supported by the Kings of France and Scotland and the Count of Flanders, as well as by Henry's own sons; but it was, nevertheless, unsuccessful. The great legislative acts of the Assize of Northampton (1176), an expansion of that of Clarendon; the Assize of Arms (1181), the basis of the military system, subsequently developed under Edward I. in the

Statute of Winchester, and the Assize of the Forest (1184), signalled the next period of the reign. Henry's last years were embittered by the ingratitude of his sons, who, though all generously provided for, continually intrigued against him and allied themselves with his enemies. Henry, the eldest, was crowned in 1170 but in 1174 acted with his father-in-law, Louis VII., in the great revolt, and in the year of his death (1183) again with Geoffrey took arms against his own father. Philip Augustus, the new King of France, aided Henry's younger sons, and Henry was at war with them when in July, 1189, he died at Saumur.

[BECKET.]

Henry III., son of King John and Isabella of Angoulême, was born in 1207, and succeeded to the throne in 1216. William Mareschal, Earl of Pembroke, up to 1219, and afterwards Archbishop Langton and Hubert de Burgh strengthened the hands of Henry during his minority. The Great Charter was renewed, the alien Papal legates (*legati a latere*) were withdrawn from the realm, and the foreign mercenaries were dismissed. In 1232 the Regency closed, and for two years the king was in the hands of Peter des Roches, the Poitevin Bishop of Winchester. Even after his dismissal foreign influence was predominant, and in 1236 gained fresh ground when Henry married Eleanor of Provence. The extent to which this grew led to the formation of a baronial opposition, the clergy also joining in the movement on account of the Papal exactions. It was not, however, till 1252 that a great leader appeared in the person of Simon de Montfort (q.v.), himself a foreigner, who had married the king's sister and acquired the earldom of Leicester. In 1258 things came to a head in the Mad Parliament, which entrusted the real government to a committee of barons. Before long the latter broke up into sections and in 1261 the king regained power. In 1263 the Barons' War broke out, and De Montfort having been victorious at Lewes summoned an assembly in 1265 in which burgesses as well as knights of the shire were invited to sit. Prince Edward, Henry's son, soon, however, escaped, and was joined by the part of the baronage who were jealous of De Montfort; and at Evesham the latter was defeated and slain. During the rest of the reign the influence of Prince Edward, who was a constitutionalist, but unwilling to submit to baronial dictation, was supreme. Henry III. died in 1272, after a reign of fifty-six years. During this long period the first conception of a Parliament, or non-feudal assembly, first appeared, the Friars established themselves in England, and the University of Oxford became an influence in national life. [MONTFORT, HUBERT DE BURGH, GROSSETETE, etc.]

Henry IV. was the eldest son of John of Gaunt, Duke of Lancaster, and was born at Bolingbroke, Lincolnshire, in 1366. By his first marriage he acquired the Hereford property, and in 1385 was created Earl of Derby. He was one of the five Lords Appellant who, in 1381, impeached the ministers of Richard II., but afterwards supported that king. In 1398, however, he was banished for

ten years, the king probably thinking the quarrel with Norfolk a good opportunity of getting rid of two such powerful nobles. Next year Richard confiscated the Lancaster estates, and the new duke, relying on his popularity, returned to claim them. He was so well received that he found it not difficult to obtain the deposition of Richard and the offer of the crown to himself. He conciliated the Church by the statute *De Haeretico Comburendo* (1401), and defeated and captured Douglas, the great Scottish captain, in the following year. In 1403 he defeated a combination of the Percies and the Scots at Shrewsbury before their Welsh ally was able to join them. Two other risings were crushed later in the reign, and after the last (1408) Henry was able to intervene in the affairs of France, where he supported alternately the Burgundians and Armagnacs according as he found it to his advantage. In 1406 the heir to the Scottish crown fell into his hands, and was kept a prisoner. Henry IV. was twice married, and three of his sons by Mary Bohun, his first wife, played important parts in English history. This king died in 1413. His reign was the high-water mark of parliamentary power under the Plantagenets, owing to the weak position of the king and his financial necessities. [HOTSPUR, GLENDOWER, LOLLAARDS.]

Henry V., eldest son of Henry IV., was born at Monmouth in 1388. He displayed great military ability during the reign of his father, but the jealousy of the latter appears to have excluded him from political influence. He came to the throne in 1413, and just as he was setting out to prosecute his claim to the crown of France had to punish a conspiracy in which Richard, Earl of Cambridge, his kinsman, was involved. He sailed from Southampton in August, 1415, and, after besieging Harfleur and losing two-thirds of his army chiefly by famine and disease, set out on that perilous march to Calais which ended in the victory of Agincourt (q.v.) (October 25, 1415). A naval victory followed in the next year, and in 1419 an alliance with Burgundy was concluded. The result was the Treaty of Troyes, by which Henry, as husband of the Princess Catherine, was acknowledged heir to the crown of France and Regent during the life of her father, Charles VI. The Dauphin and the Armagnacs refused to submit, but were defeated. Henry died in August, 1422, while advancing against them. Henry V. was the most popular of English kings. He went still farther than his father in his repression of Lollardism, and this policy was generally approved. The stories of his early life, though not historical, are by no means wholly to be rejected. [AGINCOURT, LOLLAARDS.]

Henry VI., eldest son of Henry V., was born at Windsor in 1421, and was titular king before he was a year old. The Regency was in the hands of his uncle, the Duke of Gloucester, but his great-uncle Henry, Cardinal Beaufort, also exercised great influence. Another uncle, the Duke of Bedford, was entrusted with the conduct of affairs in France, where the centre of interest of the first period of the reign lies. Bedford maintained the alliance with Burgundy for some years, but was much

hampered by the ambition of Gloucester. In 1420 Joan of Arc (q.v.) raised the siege of Orleans, and after this, though Bedford won a great victory at Verneuil in 1424, the tide turned against the English. Though Joan was captured and put to death in 1430, the Treaty of Arras healed French dissensions, and the wise leadership of Bedford was lost soon after. In 1444 a truce between England and France was made, and was followed by the marriage of Henry VI. to Margaret of Anjou, a niece of Charles VII. Two years later both Beaufort and Gloucester died, and the government fell into the hands of Margaret and of the Earl of Suffolk who had negotiated her marriage. Their conduct of the war was distrusted, and in 1449 Suffolk, was impeached and banished, but was beheaded on the high seas by a supposed pirate. In 1450 Normandy was lost, the rebellion of Jack Cade against the misgovernment of the nobles took place, and Richard, Duke of York, began to be prominent. The queen's favourite, was, however, the Duke of Somerset, and York became Regent of Ireland. From thence he returned and insisted on a reform in the Council, which was granted. In 1453 Guienne was lost, and in the same year the king showing signs of mental weakness, a struggle for the Protectorate began between Somerset and York. The latter was appointed early in 1454, but the king soon recovered. Next year the Wars of the Roses began, and after his victory at St. Albans York became again Protector for four years. The struggle was renewed in 1459, and York was attainted at Coventry by a Lancastrian Parliament. In the following year, however, he won a victory at Northampton, after which he claimed the crown; but the queen raised an army in the north, and at Wakefield the Duke was defeated and slain. The battle of Towton (March, 1461) put a period to the Lancastrian triumph, and Henry was dethroned and imprisoned. He was temporarily restored by Warwick ten years later, but after the final Yorkist victories of Barnet and Tewkesbury was put to death, as was popularly supposed, by the hand of the youngest son of the late Duke of York. [BEAUFORT, BEDFORD, CADE, GLOUCESTER, JOAN OF ARC, WARWICK.]

Henry VII., the first of a new dynasty, was the grandson of Owen Tudor, who married Henry V.'s widow, and of Margaret Beaufort, great-granddaughter of John of Gaunt. He was born in 1456, and was recognised by his half-brother, Henry VI. From 1471 to 1485 he lived in Brittany, the duke refusing to give him up to the Yorkists. In the autumn of 1485 he landed at Milford Haven with an army of English exiles, and on August 22 defeated Richard III. at Bosworth. He was recognised as king by an Act of Parliament, and early in 1486 married, as he had promised, Elizabeth, daughter of Edward IV. He refused, however, to allow her to be crowned until after the risings of Lovel and Lambert Simnel had shown him the importance of really conciliating the Yorkists. Although, as the last male of the House of Lancaster, he had been virtually acknowledged, he had no legal claim, since Katherine Swynford

was only the mistress of John of Gaunt, and her descendants had been barred from the succession by Act of Parliament. He was really king, then, by conquest, and had to maintain his position against various pretenders. The most dangerous of these was Perkin Osbeck, or Warbeck, supposed to be a Fleming, who, claiming to be a son of Edward IV., obtained the support of Burgundy and Scotland, and at first of France. In 1497 he appeared in Cornwall, but was unable to keep together his forces, and was captured. Two years later he was executed in company with the Earl of Warwick, son of Clarence, and a confession of imposture was published.

With Henry VII. begins that tendency to absolute monarchy which is only finally checked by the Revolution of 1688. Firm government and strict economy were the chief characteristics of his internal policy. He established the Star Chamber to put down the power of the nobles and especially the practice of maintenance, or the keeping of liveried retainers who backed their lord against all law and justice. The necessity for summoning Parliaments was obviated by the practice of levying benevolences, by heavy fines for breaches of actual and obsolete laws, and by money obtained from France in liquidation of English claims to the crown, in addition to that voted by the English Parliament for the war. In 1496 the "Great Intercourse," a commercial and political treaty, was concluded with Flanders. Moreover Poyning's Law (1495) first secured the supremacy of the English crown over the Irish Parliament.

In foreign affairs Henry aimed at securing the position of England by marriage alliances. He separated France and Scotland by giving the hand of his daughter Margaret to James IV. By the marriage of his son Arthur, and after his death of Henry, with the daughter of Ferdinand and Isabella, he maintained the traditional alliance with Spain, and he himself proposed to marry (as his second wife) the daughter of the Emperor Maximilian. This and other matches fell through; but England was left in a firm position at his death in 1509. A history of his reign was written by Francis Bacon.

Henry VIII. was born in 1491, and succeeded Henry VII. in 1509, his elder brother Arthur having died before his father. He began his reign by putting to death Empson and Dudley, the instruments of Henry VII.'s extortion, and entered upon a more active foreign policy. He joined the Holy League against Louis XII. of France, and defeated an incursion of his ally, James IV. of Scotland, at Flodden in the same year as the battle of the Spurs. At the peace which followed he received large sums in satisfaction of his claims, and gave his sister Mary in marriage to the French king. Another short war followed the accession of Francis I. (q.v.), and in 1519 Henry was a candidate for the Empire. From 1514-1529 Wolsey was Chancellor, and incurred all the unpopularity which the arbitrary means of raising money for the wars caused. For some years the alliance with the new Emperor, Charles V., who was nephew of Queen

Katharine, continued; but Henry and Wolsey, though inclining to him, really preferred holding the balance between him and Francis. Thus the meeting at Ardres, called the "Field of the Cloth of Gold," was allowed to take place as well as the visit of the Emperor to Canterbury. In 1523 peace was made with Scotland.

After the battle of Pavia and the sack of Rome, England changed sides, and in 1528 war was declared against Charles V. Meanwhile, however, Henry, not having a male heir, had begun to wish for divorce from Catherine, and when he fell in love with Anne Boleyn was determined to obtain it at all costs. The Pope, however, overawed by the Emperor, granted only a joint commission to examine the demand, and then revoked the case to Rome. Wolsey was now disgraced, and died in the following year (1530).

The Reformation, which had begun in the Parliament of 1529, followed. In 1531 the clergy, who had been brought under the penalties of *præmunire* for acquiescing in the legatine authority of Wolsey, had to purchase their pardon by acknowledging Henry as supreme head of the Church. Annates were in 1532 provisionally withdrawn from the Pope, Henry was married to Anne Boleyn in 1533, and appeals to Rome were made unlawful; and in 1534 a definite separation from the Papacy was completed. In 1536 the smaller monasteries were visited and suppressed, and in 1539 the larger houses shared the same fate. The abbots lost their places in the House of Lords, and most of the ecclesiastical property was granted to the new nobility. It was next made high treason to question the royal supremacy or the change in the succession, and Sir Thomas More and Bishop Fisher suffered death on the former ground. In 1536 Anne Boleyn was beheaded, and a new change was made in the succession, the king marrying Jane Seymour, by whom he at length had a male heir, afterwards Edward VI.

There was a great deal of discontent at the recent events coupled with the agrarian changes. Risings took place in Lincolnshire and Yorkshire (the "Pilgrimage of Grace"), but were put down. The king, however, was not prepared for the doctrinal changes which his Chancellor and Vicar-general, Thomas Cromwell, favoured, and he showed his displeasure on the occasion of the marriage, negotiated by the latter, with Anne of Cleves. In 1539 the Anglo-Catholic party, led by the Duke of Norfolk, had obtained the enactment of the Six Articles, making penal a refusal to accept the chief Romanist doctrines, and in 1540 Henry repudiated his fourth wife, and assented to a bill of attainder against Cromwell, who was executed.

The king now identified himself with the reaction by marrying a niece of the Duke of Norfolk, who in 1542, and for similar causes, shared the fate of Anne Boleyn. In 1543 Henry married Katharine Parr, who survived him. The remainder of the reign was occupied in wars with France and Scotland. The alliance with Charles V. was renewed in 1544, but was never, owing to late events, very cordial; and Henry, abandoned by his ally, made peace two years later, receiving the promise of a pension from France.

The Scots were unsuccessful in their raid in 1542, James V. being routed at Solway Moss; but the French still retained considerable influence in Scotland. Before the king's death the Protestant party gained influence over him, and Norfolk was imprisoned and his son beheaded in 1546.

Parliament had granted to the king the right of nominating his successor, so that when in 1547 Henry VIII. died the succession of his son was assured. Besides being politically able, he was a learned theologian, and it is probable that he really felt grave doubts as to the validity of the dispensation which allowed him to marry his brother's widow. [WOLSEY, CROMWELL, THOMAS MORE, REFORMATION.]

Henry III., "THE BLACK," Holy Roman Emperor, son of Conrad II., was born in 1017, and succeeded to the imperial dignity in 1039. His power was supreme both at home and abroad. He kept in his own hands the duchies of Franconia and Suabia, whilst the others were either left vacant or given to relatives, and his control over ecclesiastical fiefs was equally complete. Internal peace was maintained with the strong hand. In Rome the emperor was more absolute than any German prince had hitherto been. He deposed three Antipopes, and appointed Clement II. in 1042 to the Papal chair; and was granted the right of nominating future Popes by the Synod and the title of Hereditary Patrician. He also maintained his feudal superiority over Hungary, which he compelled to pay tribute. Henry III. died in 1056.

Henry IV. (son of Henry III.) was born in 1050, and was elected King of the Romans when a child. He was not crowned emperor till the year 1070; five years later at Hohenburg he avenged himself on the Saxon nobles for the humiliating terms he had been previously obliged to make with them, but his triumph was only for a time. In 1076 the great Investiture struggle began. Both Pope and emperor claimed a voice in the appointment of each other, and Gregory VII. declared it to be a sin for an ecclesiastic to accept any benefice under conditions made by a layman. Henry proclaimed the deposition of Gregory, who, in his turn, excommunicated him and declared his subjects absolved from their allegiance. The uncrowned emperor, finding himself without support in Germany, came to Italy in 1077, and obtained absolution, after standing barefoot and clothed only in a hair shirt for three winter days and nights in the courtyard of Canossa. The contest, however, was soon renewed; and the excommunication of Henry was answered by the nomination of a new Pope, by whom, after Rome had been captured, Henry was at length crowned. Gregory took refuge at first in San Angelo, and afterwards with Robert Guiscard, and the emperor was, for the time, victorious. He now, however, had to deal with fresh trouble in Germany, caused by his turbulent nobility, and no sooner were they subdued than he appeared again in Italy to meet the Guelph nobles. In spite of his efforts, even his natural son Conrad turned against him, and soon after his coronation as King of the Romans the heir to the Empire

himself was induced by Pope Paschal II. to depose and imprison his father. The last days of the great Emperor were passed at Liège, whither he had escaped, and where he died in 1106. HENRY V. (1106-26) continued the struggle, which was brought to a conclusion by the compromise of the Concordat of Worms (1122).

Henry, surnamed "the Lion," Duke of Saxony and Bavaria (1129-95), head of the Guelf family, was the most powerful German noble of his time. A great league was formed against him in 1166, but he was at first supported by the Emperor Frederick I. In 1180, however, he was deprived of his dominions, and put to the ban of the Empire, and was not restored until 1192 by Henry VI. He was the founder of Munich, and to his protection Hamburg and the Baltic ports owed much of their growing prosperity. He married Matilda, daughter of Henry II. of England.

Henry the Navigator, PRINCE, third son of John I. of Portugal, by Philippa, granddaughter of Edward III. of England, was born in 1394, and first distinguished himself at the capture of Ceuta in 1415. From that time he devoted himself to the extension of maritime discovery and commerce. He established a school of navigation at Sagres, and, as a first measure, sent out expeditions to round Cape Bojador, the southernmost point then known. In these efforts Madeira and Porto Santo were discovered. Bojador was first rounded by Gil Eannes and John Diaz in 1434. Two years later another expedition under Baldaya proceeded 120 miles farther to the southward, and so, little by little, Cape Blanco, the isle of Arguin, Cape Verde, and the mouth of the Gambia were added to the maps. Prince Henry, after a most useful and well-spent life, died at Sagres in 1460. He deserves to be regarded as the father of modern maritime discovery.

Henry I. (1005-60), the third of the Capel line, succeeded his father Robert in 1031. He was succeeded by his eldest son, Philip I.

Henry II. was born in 1519, and succeeded his father Francis I. in 1547. He carried on the policy of the latter by allying himself with the German Protestants against the Empire, and obtained for France the three duchies, Metz, Toul, and Verdun. In 1557, however, his troops met with reverses in Italy and at St. Quentin, the last great disaster being only partially compensated by the recovery of Calais from England. In the year of the treaty of Cateau Cambrésis (1559) Henry was mortally wounded in a tournament by the captain of the Scottish Guard, Montgomery. This king strongly resembled in character Francis I., but the influence of the Guises led him at times to adopt a Catholic policy. His wife was the celebrated Catherine de Medici (q.v.), and his favourite mistress Diane de Poitiers.

Henry III., third son of Henry II., was born in 1551, and succeeded his brother Charles IX. in 1575. Previously to this he had, in command of the royal army, defeated the Huguenots at Jarnac and Moncontour (1569), and had been active on

the day of St. Bartholomew (August 24, 1572). Next year he was elected King of Poland. His reign in France is noteworthy as the period at which the religious wars reached their height. The struggle was not, however, solely between Catholic and Huguenot, but was complicated by the ambition of the Guises and the Queen-mother, Catherine de Medici. The weak king, at first led by religious fanaticism to support the Holy League against the Huguenots, afterwards became tired of his masters, against whom Catherine also intrigued. In 1588, at a great crisis in the affairs of Europe, Henry, Duke of Guise, was assassinated at Blois, and his brother, the Duke of Lorraine, imprisoned. The result of this was that Catholic Paris turned against the king, who was obliged to ally himself with the Huguenot Henry of Navarre. The two Henrys besieged Paris, but in August, 1589, the King of France was assassinated by Jacques Clément, a Dominican. Henry III. was the last male of the house of Valois. He was vicious and incapable, a prey in turn to dissipation and superstition.

Henry IV. (HENRI QUATRE), cousin of Henry III., was the third son of Antoine de Bourbon, and Jeanne d'Albret, daughter of the King of Navarre and Béarn, in which latter he was born in 1553. He is thus known in history as "Le Béarnais" and Henry of Navarre before he becomes Henri Quatre. He was educated as a strict Calvinist by his mother, and was brought to La Rochelle in his seventeenth year from the fear that he would be carried off to the Spanish court. The same year he was present at Jarnac. By the treaty of St. Germain, which closed the third Huguenot war, Henry of Navarre was to be betrothed to Marguerite de Valois, the sister of Henry III., and the marriage took place a week before St. Bartholomew's Day, 1572. To save himself from death in the massacre Henry had to profess himself a Catholic, and till 1576 he was practically a prisoner at the French court. Having escaped to Alençon, he again took command of the Huguenot army, and by his conduct aided greatly the cause of his co-religionists. In the last years of Henry III. the cousins were allied against the Guises and Spain, and on the death of the king Henry of Navarre claimed the crown as nearest male descendant of the house of Valois. He was opposed by Philip II. of Spain on behalf of his daughter, while the League put forward Cardinal Bourbon, and thus divided the Catholic interest. In 1590 Henry defeated Mayenne, Bourbon's general, at Ivry, and after three years of fighting he came to the conclusion that Paris was well worth a mass ("Paris vaut bien une messe"), and therefore formally recanted his Protestantism before the States-General, who at the same time declared the Spanish pretensions invalid. Paris admitted him within its gates next year, and from this time Henry was virtually king, although the war went on till the Peace of Vervins in 1598. In that year was issued the Edict of Nantes, giving freedom of worship to the Huguenots. During the reign of Henry IV. the work of organising the kingdom begun by

Louis XI. was again taken up. Great financial reforms were carried out by the Duc de Sully (q.v.), to whom Henry in great measure owed his position, and by the making of roads and canals the different provinces were brought more closely together, and France began to become one united well-administered kingdom. Henry had just married a second time, and was contemplating a fresh war with Spain, when, on May 14, 1610, he was assassinated by Ravaillac, who had been instigated by the Jesuits. Henry IV. was, with the possible exception of Louis IX., the greatest of the French kings. The necessities of his position made him, like Frederick the Great, a Protestant hero, but he was in no sense attached to religious principles, and, in spite of many fine qualities, was, in his private life, as licentious as most Frenchmen of the time.

Henry of Huntingdon. [HUNTINGDON.]

Henry, JOSEPH, an American electrician and meteorologist, was born about 1799 at Albany, New York. While a watchmaker's apprentice he eagerly devoted himself to scientific studies, with such success that in 1832 he was made professor of natural philosophy at Princeton. In 1846 he became secretary of the newly-founded Smithsonian Institution, and held this post almost until his death in 1878. He made important discoveries in connection with the electro-magnet, and took much interest in meteorology, being first chairman of the National Lighthouse Board. A memorial of him was published by order of Congress in 1880.

Henry, MATTHEW (1662-1714), author of an *Exposition of the Old and New Testament*, commonly known as *Henry's Bible*, was born in Flintshire, and died at Nantwich. He had charge of Nonconformist congregations at Chester and Hackney. His commentary was finished by other ministers, and is still a standard work rather by reason of its devotional character than on account of its exegetical value.

Henry, PATRICK (1736-99), one of the most influential leaders in the American War of Independence, was born in Virginia. Having failed as a shopkeeper and a farmer, chiefly on account of his extravagance, he became a lawyer in 1760. Three years later he made his reputation as an orator in a case relating to the revenues of the clergy. An action was brought by a minister to recover his salary, which was payable in tobacco. As that commodity had lately greatly advanced in price, the Virginian Legislature had commuted payment to a sum of money in the ratio of the former value. Henry appeared for the defence and carried his point, the importance of the action lying in its political character, since the royal assent had been refused to the Commutation Act. The eloquence of Henry in this case produced a profound impression, and henceforth his professional career was assured. As a member of the House of Burgesses he, in 1765, moved and carried resolutions against the Stamp Act, and in 1774 he was a delegate to the Virginia Convention, where next year he delivered his second great speech on the motion that the colony be put in a state of

defence. He was a member of the Continental Congress of 1775, and next year was elected first republican Governor of Virginia, being re-elected in 1777, 1778, and 1784. In 1788 he opposed the ratification of the Federal Constitution as being prejudicial to the liberties of the separate states. In 1794 he retired into private life, and next year declined the Secretaryship of State offered him by Washington. There are several lives of Patrick Henry, the most recent being by his grandson, William Wirt.

Henry's Law, relating to the solution of gases in liquids, was enunciated in 1803, and states that "under equal circumstances of temperature water takes up in all cases the same volume of condensed gas as of gas under ordinary pressure." Hence, owing to the relation between the volume and pressure of gases [BOYLE'S LAW], it follows that the quantity of gas absorbed by water varies directly as the pressure of the gas. The law was extended by Dalton, who showed that in the case of a mixture of gases, the quantity of each gas absorbed depends only on the pressure exerted by that gas, and not on the total pressure due to the mixture.

Henslow, JOHN STEVENS (1796-1861), was born at Rochester and educated there and at Cambridge, where he graduated B.A. in 1818 and M.A. in 1821. He became professor of mineralogy in 1822, and of botany in 1825, and did much to render science popular in the university. His most distinguished pupil was Charles Darwin, whom he recommended to accompany the *Beagle*, but from whose distinctive tenets he differed to the last. In 1832 he became vicar of Cholsey, Berkshire, and in 1837 of Hitcham, Suffolk, where he died. Here he distinguished himself by introducing popular science-teaching into his village-schools and by other philanthropic efforts. He also took a leading part in establishing the Ipswich Museum and that of Economic Botany at Kew.

Hepatica, a sub-genus of *Anemone* (q.v.) distinguished by having the involucle of three undivided leaves close to the flower and by having no tail-like persistent styles to the carpels. *H. triloba*, a European species, with blue, pink or white flowers, is common in our gardens, and the fancied resemblance of its trilobed leaves to the liver gave the group its name.

Hepaticæ. [LIVERWORTS.]

Hephaestus was a god of the Greek mythology, almost corresponding to the Roman Vulcan. He was the god of fire, and the patron of those who worked in iron and other metals. The son of Zeus by Hera, he was thrown from heaven by his mother on account of his deformities. He was restored, and a second time thrown out by Zeus, and upon this occasion he fell into the isle of Lemnos, breaking his leg in his fall. Here he built a palace and established forges, and he had also forges under Etna, where, with the aid of the Cyclopes, he forged the thunderbolts of Zeus and the arms of the gods. He it was who created Pandora. His wife was Aphrodite, and her amours caused

Hephaestus much annoyance, and on one occasion he caught her and her lover and exposed them to the view of the assembled gods. His portraits generally represent him as lame, and with some accompaniment having reference to his connection with metal-working.

Heptanes are paraffin hydrocarbons (q.v.) possessing the formula C_7H_{16} . Theoretically, 9 different heptanes are possible, and of these 4 are known. Ordinary or *normal* heptane boils at 99° , and is found in petroleum. By the replacement of one hydrogen by the group OH, *heptyl* alcohols result, and 23 different varieties are known. By oxidation these yield a number of *heptoic* (or *anathylic*) acids, having the composition $C_6H_{12}COOH$, which are all fatty-smelling oily liquids.

Heptarchy is applied as a collective term to the seven kingdoms supposed to have existed in England in Anglo-Saxon times before the final supremacy of Wessex. In reality there were many more than seven kings and kinglets, but Wessex, Sussex, Kent, East Anglia, Mercia, and Northumbria became at one time or another more powerful than any of the others.

Heptoses are carbohydrates (q.v.) possessing the formula $C_7H_{14}O_7$, and in many respects resemble the ordinary *glucoses*, which possess 6 carbon atoms. From these, however, they differ in one important respect, being not fermentable by yeast. [GLUCOSSES.]

Hera, in Greek mythology, the queen of the gods, sister and wife of Zeus, and daughter of Kronos and Rhea. She was said to have been born at Argos or Samos, and in the latter island her marriage was thought to have taken place, whence the epithet sometimes applied to her of Samian. In each of these spots she had temples, and was a special object of worship. She is represented as obdurate and jealous, and often visited with her wrath the various objects of her husband's wayward amours, for instance, Latona, Semele, Alcmene, and Io. She hated and persecuted Hercules, and nided the Greeks in the Trojan War. She is often represented with a crescent, and her most usual accompaniments are Iris, the peacock, the goose, and the cuckoo, or one or more of them. Her festival, the Heraea, was held at Argos every five years.

Heraclea. 1. An ancient town of Magna Gracia near the Gulf of Tarentum, between the rivers Siris and Aciris, was a colony from Thurii and Tarentum, and, till the time of Alexander of Epirus, the central meeting-place of the Italian-Greek colonies. Here Pyrrhus beat the Romans in 280 B.C., and the city was still prosperous in the days of Cicero. In 1753 fragments of inscriptions were discovered here, one relating to a temple, and the other containing the Lex Julia Municipalis of 45 B.C. These are now in the National Museum at Naples.

2. **HERACLEA MINOA**, in Sicily, near which Regulus defeated the Carthaginian fleet, 256 B.C.

3. **HERACLEA PONTICA**, in Phrygia, where there are coal-pits which supply Constantinople.

4. The name of one of the islands called Sporades.

Heraclitus, a Greek philosopher who flourished towards the end of the 5th century B.C., was born at Ephesus, where he might have attained to high political position had he not preferred to devote himself to philosophy. For some time he travelled, especially in Africa, and on his return to his native city he still refused all dignities, and shortly after adopted a hermit life, dying at the age of 60. The fragments of his writings that remain show him to have belonged to the Ionic school, though there were some points of difference. According to him, fire is the original element of all things, and all existence is in the way of evolution from it. The fire possesses a rational principle, and is the source of soul. It is in a continual motion upwards and downwards from heaven to earth and earth to heaven, and man's soul is part of the fire from heaven which is always tending upwards. The only repose is where there is equilibrium between the ascending and descending forces. Heraclitus greatly influenced Plato and the Stoicks, and disciples of Hegel have found striking anticipations of his modes of thought in those of the Greek philosopher.

Heraclius (reigned 610-641), one of the Roman Emperors of the East, was born about the year 575, being the son of Heraclius, Exarch of Africa. The father gained some notable conquests over the Persians, and when Phocas, who had killed Mauritus and usurped the throne, was attacked by insurgents, the throne was offered by these to the elder Heraclius. After some coqueting he declined it, but sent his son from Carthage with a fleet to aid the rebels. On the arrival of Heraclius the younger at Constantinople, the insurgents killed Phocas and put Heraclius on the throne. He was a good ruler, but could not make effectual head against the advance of Mahomet, and his son Constantine III. succeeded to the throne of a fast-decaying empire.

Herald (Old High German *herolt*, for *hari-wald*, "army-strength"), originally an officer employed to convey proclamations of peace and war, and other messages from the court of one sovereign or feudal lord to that of another. When the science of heraldry (q.v.) grew up in the western countries of Europe, it became the business of heralds to see that the regulations concerning the bearing of coat-armour were properly observed, and this range of duties further required a knowledge of genealogies and the descent of titles. Commonly each order of knighthood had its own herald with an attendant body of "pursuivants" whom he was supposed to train in the duties of the office. The "York," "Windsor," and other heralds are frequently mentioned in English documents of the 14th and 15th centuries. The chief herald was known as the "King of Arms;" in England in the 14th century there were two such "kings," "Norroy" and "Surroy" (afterwards "Clarendon"), exercising authority north and south of the Trent respectively. Under Henry V. a new king of arms, the "Garter," took precedence of the other two. The "Lyon" and "Ulster" kings of arms exercised similar functions in Scotland and Ireland. The

Heralds' College, or College of Arms, was instituted, under the direction of the Earl Marshal, in 1483, and in 1554 the members were located in the building in London which they now occupy.

Herald Moth (*Gonoptera libatrix*, Linn.), a species which lives on willows and spins cocoons, which it protects by binding together the leaves at the end of twigs. The moth lives for more than one summer, and it passes the winter hibernating in outhouses, etc.

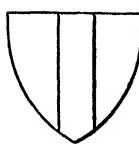
Heraldry, which has been truly called "the shorthand of history," as a word at the present time carries a meaning rather different from that which it has conveyed at other periods—changing perhaps as the duties of a herald have been modified. As ordinarily used, it is intended to signify what is more definitely expressed by the word "armory," and it includes all matters relating to arms and crests or appertaining to an armorial achievement. But the regulation of armorial bearings is but a portion of the duties falling to the lot of the herald, for the science of heraldry really also concerns the marshalling of processions and conducting of the ceremonies of coronations, the installations, creation of peers, funerals and marriages, the declaration of war, and the proclamation of peace—and, during the Middle Ages, the bearing of letters and messages of courtesy and defiance between royal and knightly personages. Further, a herald was held responsible for the superintendence of trials by battle, tournaments, jousts, and such like encounters; and in the still earlier times for the numbering of the dead after the conflict and the recording of the valiant deeds which had been performed were part of his work.

It is difficult—well-nigh impossible—to place a definite line between ornament pure and simple and heraldry; for the latter is simply the codification, as it were, of certain acknowledged forms of ornament and certain opportunities for the display of ornament and the combination and the usage of a combination of the two under certain known and acknowledged laws, originally self-apparent or legally imposed.

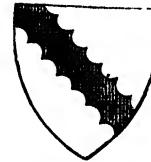
The Japanese at the present day have their badges—well-known, simple, and hereditary—which have existed for centuries and which are now and have been always displayed in a manner very similar to the usage of such ornaments in the Tudor days. In Hindustan it is easy to assimilate the hereditary symbols with Western ideas and heraldic laws. Even among the North American Indians tribal "totems" have an acknowledged existence and an appreciable value.

All such marks are borne for the purposes of *distinction* in one or the other meaning of the word, more frequently in *both* of its meanings. That such symbols should from the far remote ages have been placed upon the shield which was carried in battle is easy enough to understand; for a man's weapons and his armour were his most cherished possessions; he loved them, he decorated and took care of them. He placed strengthening bars of wood or metal across them in various positions and ne painted these of a different colour, or polished

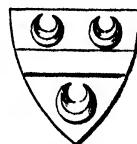
them into prominence. And from this simple reason have been evolved the fesse, the pale, the chief, the bend, the chevron, and those other familiar figures which are known as the *ordinaries* and *subordinaries*. Over all, or conveniently placed and disposed in relation to his strengthening bars, he painted his favourite "devise" or "connoissance," and such is the origin of the coat-of-arms—the



PALE.



BEND ENGRAILED.



FESSE.

"écusson" or escutcheon of later days. For such devices being very early used to decorate the shields, a practice known to the Greeks of old, and possibly pointing back even to totemism (q.v.), the term "arms" was soon applied to them, and the expression he "bears" such and such arms soon came into use. In the thirteenth century it became usual to embroider the "arms" upon the surcoat which was worn over the coat-of-mail, and the former consequently became a "cont-of-arms," hence the latter term.

The date of the resolution of heraldry into a science has yet to be discovered. Emblems or figures—call them what you will save arms—undoubtedly appeared upon the shields of the Normans as figured in the famous tapestry of Bayeux, but it requires a stretch of diction and imagination to admit these as arms: and no mention which can be so construed is to be found of the heraldic decoration of shields in any of the minute and detailed accounts of the First Crusade. Their existence at the time of the second can hardly be taken as an indisputable fact; but before the third, armorial bearings were in accepted and very general usage throughout Europe.

Very soon after their introduction arms became hereditary, and the reason is not far to seek. The son inherited his father's lands and responsibilities, he espoused his father's quarrels and was proud to use the weapons his father had fought with. Thus it was general for the son to carry a similar shield.

And one of the earliest—perhaps *the* earliest—of heraldic laws is one which points to a keener appreciation of art and colour on the part of our early progenitors than we may be inclined to give them credit for. Drawing-masters of to-day point out the necessity of contrast to show up the various colours, e.g. that a red band across a blue background is not so brilliant as across a white one, and that by placing white spaces between the blue and the red the brilliance of both is heightened. And this same idea will account for the said law in heraldry that neither colour may lie upon colour nor metal upon metal. For heraldry knows but two metals "or" and "argent" (gold or yellow and silver or white), whilst the colours ordinarily in use are "gules," "azure" "vert," "sable," and "purpure" (viz. red, blue, green, black and purple). Furs, which are always mixtures of metal and

colour, may be surmounted by either but not by another fur.

One of the greatest mistakes in the popular conception of heraldry, and one that has argued very fatally against that science, is to suppose that every charge upon a shield must have some legend connected with it, or that it is placed there to exhibit some positive meaning.

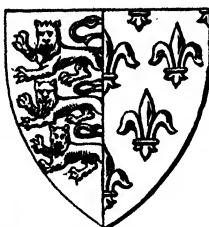
Undoubtedly some *explanation* is frequently forthcoming for the charges upon ancient and for a large number of the modern coats-of-arms; for a



COCKATRICE.



WYVERN.



DIMIDIATION.

very large proportion of all coats-of-arms turn out upon investigation to be "canting" arms, as they are termed, which may be readily explained as containing some pun (frequently very far-fetched) or anagram relating to the names or estates of the first owner of the escutcheon. For instance, the water-bougets borne by Lord De Ros at the present day originated with the Trusbut family, whose heiress married a De Ros. The Trusbuts, Barons of Wartre in Holderness, bore arms in which the water-bougets were anciently blazoned ("to blazon" is to heraldically describe a coat-of-arms in words, and a "blazon" is such a description) "trois boutz d'eau," thereby punning both their own name and the name of their estates.

Still further, many Crusaders on their return from the Holy Land placed bezants, escallop-shells, crosses, palmer's staves, and Saracen's heads upon their shields; but it would be folly on that account to attempt to state that every person upon whose escutcheon a bezant or an escallop shell is placed had an ancestor in the Holy Wars. The Crusades originated undoubtedly an enormous proportion of the commonly accepted heraldic "charges"; but once originated they became common property so long as their arrangements upon the escutcheon when designing a new coat did not interfere with anyone else's arms.

Many fabulous animals exist in heraldry which have no place in natural history, e.g. the dragon, the wyvern, the cockatrice, the griffin, and the pegasus, but they can hardly be said to have originated in heraldry, though in one or two cases the ancient heraldic artists must certainly be held responsible for giving a definite form and semblance to unknown though accredited monsters; and the double-headed eagle undoubtedly and perhaps also the griffin, may trace an origin

in the ancient manner of "impaling" two coats of arms by "dimidiation," i.e. by taking half of each coat and placing them together. The present revival of the mediæval style of draughtsmanship in treating heraldry has much helped to preserve the antique forms of some of these chimerical conceptions.

Heraldry at the present day has been brought much into disrepute owing to the wholesale corruption of the art by advertising heraldic purveyors, and by the ignorant or wilful assumption of armorial bearings by those utterly unentitled to such distinction and by those who openly flout the authority of the officers of the Crown appointed to regulate such matters: for, "surely, even those who affect the greatest contempt for heraldry, will admit that, if arms are to be borne at all, it should be according to the Laws of Arms; and that if the display of them be but an empty vanity, it is a less creditable vanity to parade as our own those which belong of right to others." [ARMORIAL BEARINGS.]

Heralds' College, or, to use its more correct and grandiloquent description—viz. "His Majesty's College of Arms"—stands back surrounding its diminished courtyard area from the northern side of Queen Victoria Street, close under the shadow of St. Paul's, and belongs to the corporation of its members, who are officers of arms. These officers of arms, though holding office under the Great Seal of England and direct from the Crown, are all nominated by His Grace the Duke of Norfolk, K.G., as Hereditary Earl Marshal of England, who exercises control over the College, and upon many matters has absolute discretion and authority. At different times different and very various titles have been borne by the officers of arms, but they first acted in a collegiate capacity in the reign of King Henry V., and were incorporated by a Royal Charter in the reign of King Richard III., a further charter being granted by King Edward VI. This last provided for the existence of three Kings of arms, six Heralds, and four Pursuivants, in which style the corporation has since continued, and at the present time the officers are Garter Principal King of Arms, Clarenceux King of Arms, and Norroy King of Arms; Chester, Windsor, Lancaster, York, Somerset, and Richmond heralds; with Portcullis, Rouge Dragon, Rouge Croix, and Bluemantle Pursuivants. Various extraordinary officers have from time to time been created, and at the present time two are in existence—viz. Surrey Herald Extraordinary and Maltravers Herald Extraordinary. The jurisdiction of the English College and of the Earl Marshal extends throughout the whole of His Majesty's dominions with the exception of Scotland and Ireland—the former of which is governed in matters armorial by Lyon Office and the latter by Ulster Office. The *Records* of the College (as distinct from the *Collections*) never leave the custody of the officers of arms, and are accepted in His Majesty's Courts of Law as incontrovertible evidence, and have been likewise in other countries. These records consist of the series of books called *Visitation Books*, containing the pedigrees and arms of the nobility and gentry taken under Royal

Commissions from 21 Henry VIII. to the latter part of the seventeenth century, the last commission being issued 2 James II. Since the visitations such pedigrees have only been recorded upon voluntary application, and the books of these are termed the *Modern Records*. There are also books of the pedigrees and arms of peers compiled pursuant to the standing orders of the House of Lords of May 11, 1767, and books containing the arms and pedigrees of baronets in accordance with a Royal Warrant of 3rd December, 1788, "for correcting and preventing abuses in the Order of Baronets." In addition there are certain funeral certificates, books containing accounts of certain royal ceremonies, the books of the grants of arms, and what are known as the Earl Marshal's books, which, commencing in the time of Queen Elizabeth, contain entries of warrants under the Royal Sign Manual upon various matters. In addition to these records, the College contains the "collections" of former heralds and genealogical writers—either willed to them or acquired by purchase—which, though great in value, have not been compiled or accumulated under any royal or other warrant. The salaries of the officers are merely nominal, their remuneration being derived from fees, which by no means approach the amounts frequently supposed. A herald or a pursuivant is always "in waiting" in the Public Office to transact the business of anyone who is a perfect stranger, but the various officers have all private sets of apartments in the College, and the "practice" and "clientèle" of each officer is arranged and conducted in a manner very similar to that in vogue in the legal and medical professions.

Herat, a city of North-West Afghanistan, situate in a plain on the river Heri-Rud, 370 miles west of Cabul. It is defended by a citadel, mound, wall of sun-baked brick, and a ditch fed by water from neighbouring springs and from the river. There are several gates with streets of bazaars leading from them to a central square. Among the public buildings are mosques, caravanserais, and baths. The chief industries are the manufacture of carpets and sword blades, both considerable, and of shoes, cloaks, and lambskin caps. The trade is great, since the town is on the high road between India and Persia; moreover, it is of considerable importance in times of war. The chief objects of trade, which is carried on mostly by Hindus, are assafetida, caraway seeds, dye, gum, manna, mastic, pistachio nuts, and saffron. There is also a through trade in shawls, indigo, sugar, chintz, leather, muslin, and skins. Herat was once the capital of Tamerlane's empire, and the ruins in the neighbourhood are numerous.

Herault, a department of France, having Gard to the north and east, the Gulf of Lyons on the south and south-east, Aude to the south-west, Tarn to the west, and Aveyron to the north-west, and containing 2,393 square miles. The Cevennes occupy the north-west, and from them the surface slopes rapidly to the south-east, terminating in low-lying coast with extensive

lagoons. The department contains four arrondissements, divided into 335 communes. It is drained by the rivers Herault, Orb, and Lez, which are navigable for a part of their course, and is traversed by the Canal du Midi, which terminates in the lagoons. About one-sixth of the department is arable, and produces a considerable quantity of grain, and there are extensive vineyards and abundant fruit, especially mulberry and olive. Dye-plants are also largely cultivated, and fine oak timber abounds. Among the minerals are coal, copper, gypsum, marble, millstone, and slate.

Herbal, a book dealing with plants especially from the point of view of their medicinal properties. Such books were formerly numerous, but have ceased to be of much medical value. Among the more important herbals are the *Hortus Sanitatis* (1486), *The Grete Herbal* (1516), *A Little Herbal*, by Anthony Ascham (1550), those of Brunsfelsius, Cordus, Ruellius, Fuchsius, Gesner (q.v.), William Turner (q.v.) (1551-66), Dodoens (1553), translated into French by Clusius (1557) and into English by Henry Lyte (1578), John Gerard (q.v.) (1597), emended by Thomas Johnson (1633), Nicholas Culpepper, largely astrological and since often reprinted (1652), *The English Herbal*, by William Salmon (1711), and *A Curious Herbal*, by Mrs. Elizabeth Blackwell (1739).

Herbarium, a collection of dried plants for scientific study. The finest in the world is that at Kew, based upon those of Sir W. J. Hooker (q.v.) and George Bentham, and comprising some 100,000 species of plants. That of the British Museum contains the various collections got together by Sir Hans Sloane (q.v.) and that of Sir Joseph Banks. The herbaria of Dillenius, Sherard, and Fielding are preserved at Oxford, and that of Linnaeus (q.v.) by the Linnean Society of London. Other important herbaria are those of the De Candolles at Geneva, the Jussieus and St. Hilaire at the Paris Jardin des Plantes, Grisebach at Göttingen, Asa Gray at Harvard, and Baron Müller at Melbourne. Herbarium specimens being liable to the attacks of various insects, camphor is placed near them, and they are sometimes brushed over with a poisonous mixture of corrosive sublimate and carbolic acid dissolved in spirit.

Herbart, JOHANN FRIEDRICH (1776-1841), a German philosopher whose views are formed partly on the system of Kant and partly on that of Fichte, although his great work was to oppose the doctrine of the idealists as inaugurated by Kant and carried on by Fichte, Schelling, and Hegel. His position in philosophy is chiefly that of a critic of other systems, and the first part of his labours was an analysis of the doctrines of Spinoza, Leibnitz, and Kant, and a comparison of them with those of Fichte, Fries, and Schelling. One of his special peculiarities is an endeavour to apply mathematical and mathematico-physical principles to psychology. He produced many works. Among them are an *Introduction to Philosophy*, *Manual of Psychology*,

and works on logic and metaphysics. He is of some importance also in the science of education.

Herbert, ARTHUR, EARL OF TORRINGTON.
[TORRINGTON.]

Herbert, EDWARD, commonly known as **LORD HERBERT OF CHERBURY** (1581-1648), an English author, was born at Montgomery Castle, and at an early age was entered as a gentleman commoner of University College, Oxford. In 1600 he was in London, and was knighted after marrying the heiress of another branch of his own family. He then went abroad till 1607, living a romantic and adventurous life. In 1609 he went abroad to take service with the Prince of Orange, and was again in the Low Countries with him in 1614. In 1618 he went to France as ambassador, but some arrogance of conduct led to his recall, though he returned to Paris after the death of the Constable Luynes. In 1624 he produced in Paris his chief work on *Natural Religion*, in which he argued that revelation was not needed. In 1625 he was made an Irish peer, and in 1631 an English baron. In the early part of the struggle between king and people he was inclined to the Parliamentarian side, but afterwards adopted the Royalist cause, and suffered considerably for his loyalty. He wrote also *Poems* (published 1665), *Memoirs* (published 1764), and a *Life and Reign of Henry VIII.*, and a work *De Religione Gentilium*, which was published after his death.

Herbert, GEORGE (1593-1633), younger brother of the above, was born at Montgomery Castle. He was educated at Westminster and at Trinity College, Cambridge, becoming fellow of the latter society in 1615, and being from 1619 to 1627 public orator of the university. In 1625 he was ordained, and was appointed to a prebend at Lincoln. In 1630 he was ordained priest, and appointed to the living of Bemerton, Wiltshire, where he led a life of piety and humility. He is chiefly known by his poem *The Temple*, and a prose work *The Country Parson*, and through his life, written by Izaak Walton. Parts of his *Temple* have almost passed into proverbs, e.g. "Touch not the third glass," "Constancy doth knit the bones, and make them stour."

Herbert, SIDNEY, afterwards Lord Herbert of Lea (1810-1861), an English statesman, was the second son of the eleventh Earl of Pembroke, and was born at Richmond in Surrey, his mother being a Russian lady. He was educated at Harrow, and at Oriel College, Oxford, and in 1832 entered Parliament as member for North Wilts in the Conservative interest. In 1841 he became Secretary to the Admiralty and in 1845 he was Secretary for War under Peel, and in the Cabinet. He became an advocate of free trade, and retired with Peel in 1846. He was a member of the Aberdeen Cabinet in 1852, and was Secretary for War till 1855, when he retired with his leader over the question of the Crimean War. In 1859 he was Secretary for War in Lord Palmerston's Government. In 1861 he went to the House of Lords, but his health was

broken down. He lived at Wilton near Salisbury, and the striking church which he built there is well known.

Herbivora, an old order of Mammalia equivalent to the Ungulata (q.v.).

Herculaneum, an ancient town of Italy, five miles S.E. of Naples, was buried by an eruption of Vesuvius A.D. 79. The city, said to have been founded by Hercules, was very ancient, and fought at a later period in the Social War against Rome. Later it was a fortified town and a valuable fort. It is said to have been a second time overwhelmed A.D. 472. The city was much more completely covered than Pompeii, and it was not till 1718 that an important discovery was made of three statues during the digging of a well in the village which had arisen upon the ancient site. This was followed up in 1750 by the discovery of a passage leading to the theatre, but excavation of this has been rendered difficult by the position of the village above. In a square south of the theatre, which seems to date not much farther back than the eruption, is a temple, and there is another on the east connected by a street with porticoes. One of these temples was restored by Vespasian. To the north of the theatre is a basilica 228 feet long by 132 feet wide surrounded by 42 columns. Many paintings were found here. The discoveries at Herculaneum have been of a most interesting description, and throw a great deal of valuable light upon the arts, mode of life, etc., of the period of their entombment. Very many statues have been found, a private villa, and many more houses, and remains of food even had not perished. The scarcity of human remains seems to show that most of the people had time to escape. Among the most precious of the finds are a quantity of papyri, but some of these are useless through the effects of heat and other agencies, though many have been unrolled and the contents published. Unfortunately they are not of first-rate interest, bearing chiefly on the details of the Epicurean philosophy. The Naples Museum is rich in remains of Herculaneum, which city seems to have been better provided with art-treasures than its sister Pompeii.

Hercules, called in Greek HERACLES, or ALCIDES, is a half-mythical demigod of Greek mythology, chiefly to be regarded as embodying the perfection of physical manhood, and as illustrating the perpetual struggle of *la bête humaine* against the higher impulses of man's nature. Hercules was the son of Zeus by Alcmene the wife of Amphitryon, whose son he was generally supposed to be. When he was a few months old Hera, in her jealousy, sent two snakes to kill him, but the child strangled them. He was afterwards carried to heaven and surreptitiously placed at Hera's breast, thus imbibing a further portion of divine nature. Returning to earth he grew up at Thebes, being taught by Castor to fight, by Eurytus to shoot, by Autolycus to drive, and by Eumolpus to sing, the finishing touches to his education being given by Cheiron the Centaur. A legend relates that at the outset of life he had the choice of following

pleasure or virtue, and that he chose the latter. At eighteen he killed a lion on Mount Cithæron, and Thespius's fifty daughters became pregnant by him. After the slaughter of the lion Kreon of Thebes gave Hercules his daughter in marriage, and handed over to him the government of the country. But Hera drove him mad, and caused him to kill his children during a delirium in which he imagined them to belong to Eurystheus, who had summoned him to Mycenæ. He retired from public life and consulted the oracle, which ordered him to subject himself to Eurystheus for 12 years, during which he performed the well-known twelve labours, being armed for their accomplishment by the gods. The labours were (1) the slaughter of the Nemean lion, (2) killing, with the aid of Is拉斯, the Lernæan hydra, (3) capturing the stag with the golden horns and brazen hoofs (which involved him in a quarrel with Artemis), (4) slaying the Erymanthian boar, (5) the cleansing of Augæas's stables, (6) the slaughter of the Stymphalian birds, (7) capturing the Cretan bull, (8) capturing the mares of Diomedes, (9) taking the girdle of the Queen of the Amazons, (10) killing the monster, Geryon, King of Gades, and carrying off his flocks (in the course of which he set up *The Pillars*), (11) the taking the apples of the Hesperides, (12) carrying Cerberus from Hell to the upper world. Many minor feats Hercules also accomplished, and one of his adventures, illustrated by sculptors, was his period of slavery to Omphale, Queen of Lydia. His marriage to Deianira led eventually to his death; for when Nessus the Centaur offered violence to the wife Hercules killed him, and the dying Centaur told Deianira that his blood would bring back her husband's love if it should ever wander from her. Finding him later enamoured of Iole, a former love, Deianira gave him a tunic steeped in the poisoned blood, and Hercules, finding himself dying in torture, hastened events by causing himself to be burnt on a funeral pile. He was taken to heaven, reconciled to Hera, and married to her daughter Hebe. The cult of Hercules was widespread, and there are numerous statues of him, generally with a club and clad in the lion's skin. His career has sometimes been explained as a solar myth.

Hercules, PILLARS OF, were said to have been set up by that hero in the course of the travels that accompanied his tenth labour. They are said to have been at Calpe and Abyla, on the opposite sides of the Straits of Gibraltar, these being the limits of his western wanderings. Different stories are told of their origin, one being that he formed them by tearing asunder the rocks, another that he erected them to support a bridge for the passage of Geryon's flocks, another that he placed them to narrow the straits and keep sea-monsters out of the Mediterranean. Other pillars claim the name.

Hercules Metal, an alloy of copper, nickel, and aluminium, which, owing to its being untarnishable in air, and possessing a good colour, great tenacity, and hardness is well adapted for ornamental and scientific purposes.

Hercules Powder, an explosive largely employed in the United States, consisting essentially of nitro-glycerine (q.v.), but containing also sodium nitrate, magnesium carbonate, and wood pulp in varying quantities. The power of the explosive is about the same as that of good Kieselguhr dynamite.

Herder, JOHANN GOTTFRIED VON (1744-1803), a German author, was born at Mohrungen in East Prussia. In his youth a Russian surgeon offered to teach him surgery, and in 1762 he went to Königsberg, but fainted at the first sight of dissection. He abandoned surgery in favour of theology, and also attended Kant's lectures. He distinguished himself in general knowledge, and in 1764 was made master in the cathedral school at Riga and preacher. He gave up this post and, declining the offer of a post at St. Petersburg, began to travel. In France he acted as travelling-tutor to a German prince on tour. Disease of the eyes stopped him at Strasburg, and he there made the acquaintance of Goethe, and in 1775 Goethe's influence got him the post of court preacher at Weimar. Here he showed himself a good pulpit orator and an energetic inspector of schools. In 1801 he became President of the High Consistory, and was ennobled by the Elector of Bavaria. Before 30 he had published a work on modern German literature, and a book called *Critical Words*. His chief work was *Ideas on the Philosophy of the History of Humanity*. He also published some poems, among them *The Cid*. His works were published in 40 volumes at Stuttgart (1852-54).

Heredity, the conservative principle in inheritance, or the tendency of organisms to resemble their parents, is practically at present one of the ultimate or unexplained facts of biology. Hypothetical explanations have been suggested by Darwin (q.v.) in his theory of Pangenesis (q.v.), and by Professor Weismann in that of the "permanence of the germ-plasm." Some unexplained generalisations of the facts of heredity can be stated as "laws." Among these are the law of ontogenetic recapitulation of phylogeny, formulated by Von Baer (q.v.), that each individual in its development passes through a series of forms representing its ancestors of a less and less remoteness; that of precocity or anticipatory inheritance, pointed out by Darwin, by which characters tend to be inherited at slightly earlier stages of development; and that of atavism or reversion, by which characters sometimes skip one or more generations, offspring resembling grandparents more than parents. Another remarkable class of cases is the inheritance of certain characters exclusively by one sex among the offspring. The inheritance of acquired characters is denied by Weismann, but this question is still under discussion. The strength of this principle, even in the field of moral character, has of late been made the foundation of a literature which dangerously undermines the doctrine of moral responsibility.

Hereford, city and parliamentary borough (returning one member), and capital of Herefordshire,

on the left bank of the Wye, 120 miles W.N.W. of London. The city is situated near the centre of the county, upon rising ground, in a fertile valley. The principal streets are broad and straight, and, while the chief buildings are of stone, the houses are, for the most part, of brick. The cathedral, rebuilt by William I. and restored by Sir G. Scott in 1863, is near the river, and has a length of 335 ft. by 174 ft. wide. Other public buildings are the college, the shire hall, an eighteenth-century county gaol, a free library and museum, and a market hall. The chief industries are the manufacture of gloves, leather, turnery, nails, and the brewing of ale and porter. There is a trade in hops, wool, cider, timber, oak-bark, and agricultural produce. A music festival is held here triennially in September. Pop. (1901), 21,382.

Herefordshire, an inland county of England, having Shropshire on the N., Monmouth and Gloucester on the S., Worcester on the E., and Radnor and Brecknock on the W. It is 88 miles long from S.E. to N.W., and has an extreme breadth of 32 miles, and contains nearly 5,333,000 acres, of which 500,000 are arable, meadow or pasture. The soil is generally good, though in some places the pasture is poor. Much wheat is produced, and other crops are barley, oats, beans, peas, hops, and turnips. The surface slopes S. towards the Severn, into which flows the Wye with its tributaries the Lugg, Arrow, Frome, and others. The apple is cultivated generally throughout the county, and the cider is abundant and good. Horses are largely reared for riding, coaching, and agricultural work, and the cattle make good beef, though yielding scanty milk. The sheep are generally Cotswold and a cross with the Leicestershire breed. Farms are generally large, and oak is abundant and much exported. There are medicinal springs from the Malvern Hills, and petrifying springs in parts. The county returns a member of Parliament for each of its two divisions. Pop. (1901), 114,401.

Herero (OVA-HERERO), a large south-west African people, who occupy all the low steppe region of Damaraland between Ovampoland and Walvisch Bay north and south. The Hereros are a branch of the Bantu race, speaking a Bantu dialect closely related to that of their Ovambo neighbours and kinsmen. The chief divisions are the Zerawa, Kambambe, Kavingava, Kamureti, Kandyii, Kukuri, and Ovambanderu. The Hereros are essentially a pastoral people, who own numerous herds of a fine breed of cattle largely exported to Cape Colony and to the European settlements on the west coast as far north as the Gaboon. For generations they have been at constant feud both with the northern Ovampos and the southern Namaquas (Hottentots). But this inter-tribal warfare has almost entirely ceased since 1886, when Kamahero, lord paramount of the Hereros, accepted the German protectorate for himself and all his people. A serious rising broke out in 1904, and the Germans did not completely suppress it until 1907. The true national name is *Herero*, meaning the "Merry" or "Light-hearted," whereas *Damara* (properly *Damqua*), meaning the

"Vanquished," is a Hottentot word applied to them in contempt by the Nama Hottentots (Namaqua) of Great Namaqualand. Hence the Germans have rightly replaced *Damaraland* by the term *Hereroland* as the proper designation of their territory. The confusion is also thus avoided between the "Cattle Damaras" and the "Hill Damaras" of the eastern uplands, who are not Bantus at all, but half-caste Hottentots speaking a corrupt Hottentot dialect, and calling themselves *Hou-Khoi*, that is, "True Men," meaning "True Hottentots." (Francis Galton, *Travels*, 1853; Schinz, *Deutsch Süd-West Afrika*, 1891.)

Heresy (Greek, "choice"), the adoption by persons professing Christianity of opinions at variance with the general teaching of the Church. Heretics had already appeared in the Apostolic age—viz. Judaisers, who strove to maintain the old dispensation, Nicolaitans (Rev. ii.), Hymenaeus and Philetus (2 Tim. ii. 17), Simon Magus, and Cerinthus (q.v.). The principal heresiarchs and heretical sects are treated separately; a summary of the chief points concerning which unorthodox views arise, with the names of leaders or sects who supported them, will therefore be sufficient here. (1) The Creation and the origin of evil—Gnostics, Manicheans. (2) The Trinity—Montanists; Monarchians, Ebionites, Carpocrates, Arians; Macedonians; Photinians. (3) The Person of Christ—Arius; Valentinus, Tatian, Docetae, Monophysites, Monothelites; Cerinthus, Basilides, Nestorius, Eutyches. The laws *De Hereticis* in the Justinian Code, a collection of all preceding enactments, by which heresy was made a civil crime, involving in some cases the penalty of death, were subsequently adopted in the various kingdoms of Europe. Persons suspected of heresy were tried by the archbishop and his council in a provincial synod, and, if found guilty, were handed over to the civil arm. The English statute *De Heretico Comburendo* (2 Henry IV. c. 15) empowered the dioceses to hand over a convicted heretic to the civil arm without receiving a royal writ confirming the sentence to death. It was repealed in the reign of Charles II.

Hereward, commonly called "the Wake," a Saxon hero around whose history much doubtful legend has gathered. According to legend he was the son of Leofric of Bourn, but this seems historically doubtful. But, in any case, it seems certain that he held the "Camp of Refuge" in the Isle of Ely as the last Saxon stronghold against the growing power of William the Norman, and that eventually he had to give in to the Conqueror. Kingsley's novel, *Hereward*, develops his legendary character.

Hergest, RED BOOK OF, a MS. collection of ancient Welsh tales now in the library of Jesus College, Oxford. It is included in Lady Charlotte Guest's *Mabinogion*.

Heriot, GEORGE (c. 1563–1624), a Scottish goldsmith of East Lothian family, jeweller to James VI. of Scotland, whom he accompanied to England. His father was an Edinburgh goldsmith,

and in 1588 the son was admitted member of the Goldsmiths' Guild. In 1597 he became goldsmith to the queen. His second wife was the daughter of James Primrose, clerk of the Scottish Council, and father of the first Lord Rosebery. He died in London and was buried at St. Martin's-in-the-Fields, leaving nearly the whole of his fortune to a charity in Edinburgh, now known as Heriot's Hospital. It was first instituted in 1628. A new scheme was put forth in 1885 redistributing the revenues, which amount to about £3,200 a year. Most of us are acquainted with "jingling Geordie" through Scott's graphic sketch of him in the *Fortunes of Nigel*.

Herkomer, HUBERT VON, an English painter, etc., of Bavarian extraction, was born in Bavaria in 1849. He came finally to London in 1870, and has from that time steadily exhibited both in oil and water-colour. One of his best known pictures is *The Last Muster* (1875). He later became celebrated chiefly as a portrait-painter. His school of art at Bushey gained great renown for its training capacity. He was made a Royal Academician in 1890. He was made a Commander of the Victorian Order (C.V.O.).

Hermandad ("brotherhood"), a Spanish institution, which sprang out of an association formed towards the close of the 13th century by the cities of Castile and Aragon for purposes of mutual defence against the aggressions of the feudal nobility. It assumed a public character in 1485, when it was organised by Ferdinand and Isabella as a local police with judicial functions; at the same time it received the name of Hermandad. As the royal power grew and that of the nobles declined, the Spanish sovereigns no longer needed the support of the burgher class, and the Hermandad gradually fell into decay.

Hermann, JOHANN GOTTFRIED (1772-1848), a German philologist, was born at Leipzig. He studied law there and at Jena, and in 1794 began to lecture at Leipzig on ancient literature, being further appointed successively to the chairs of philosophy, elocution, and poetry before 1810. He was a good lecturer, and did much to improve the study of Greek grammar, and published editions of the Greek tragedians. Among his works are *De emendanda ratione Graeca Grammaticae*, *Hundbruch der Metrik*, and *Epitome Doctrinae Metricae*.

Hermann, KARL FRIEDRICH (1804-55), a German philologist, born at Frankfurt-on-Main. He was educated at Heidelberg and Leipzig, and held professorships at Marburg and Göttingen. He endeavoured to make philology and history mutually illustrate each other. He made valuable researches into the Platonic philosophy and its history, and published the *Dialogues*, a *Handbook of Greek Antiquities*, some editions of the classics, and many other works.

Hermannstadt, a town of Hungary lying amidst hills N. of the Transylvanian Alps, 54 miles S.E. of Klausenburg. The ancient fortifications,

which once rendered it a strong city, are almost gone. It is divided into the High Town, well built, with good squares and regular streets, and the Low Town, reached by flights of stone steps from the High Town, and there are three suburbs. Among the public buildings are a 14th-century church with lofty tower and interesting monuments, a Roman Catholic church, a town hall (formerly a fortified house), a palace with a good library and paintings, a university, a law academy, and two gymnasiums. The chief manufactures are woollen cloth, leather, soap, cordage, hats, combs, and earthenware, and there is a brisk trade with Constantinople.

Hermaphrodite (a name derived from the legend that Hermaphroditus, the son of Hermes and Aphrodite, was united with the nymph Salmacis into one body), a term used in zoology to show that an animal has but one sex, the male and female reproductive organs being united in the same individual—*e.g.* the common hydra.

Among plants it is a purely structural term, equivalent to bisexual or monoclinous, being used of flowers which contain both stamens and carpels, as opposed to diclinous. It does not at all necessarily imply that the flower is self-pollinating, the two kinds of organs, in fact, very often maturing at different times. [DICHOGAMY.]

Hermas, an early theologian called an "apostolic" father, from his having lived almost if not quite in apostolic times. His writings consist of some fragments of a dialogue entitled *The Shepherd*, which was greatly revered in the 2nd century, and of which a perfect Latin translation was found in Rome. It is divided into *Visiones*, *Mandata*, and *Similitudines*, and is poetic in style and Platonic in ideas.

Hermes, a god of Greek mythology, corresponding to the Roman Mercury, was the son of Zeus and Maia, the daughter of Atlas, and was born in Arcadia. Wondrous stories are told of his infancy. At the age of eight hours he is said to have invented the lyre, which he hid in his cradle, and soon after stole fifty of the gods' oxen guarded by Apollo, driving them backwards to blind the trail, and having slain two by the river Alpheus he made a fire, sacrificed a portion of them, and hid what he did not eat in a cavern. Apollo suspected him of the theft and went to Maia, but Hermes pretended to sleep in his cradle. Zeus made him acknowledge the theft, but when Apollo bound his hands, the chains fell off, and the oxen appeared two by two. Hermes afterwards charmed Apollo by his playing, and the two made a compact of comradeship. Hermes became the herald and messenger of the gods, and countless stories are told of his cunning tricks. He was also the god of eloquence, and the patron of inventors, and of roads and travellers. Our own milestone finds its origin in the statues of Hermes, known as *Hermæ*, which were placed on the roads to mark distances. Hermes is generally represented as slender and full of youthful grace, with winged cap and ankles, and carrying the caduceus

(q.v.). But he has many symbols for his different characters. His festival was called *Hermæa*.

Hermes, GEORG (1775-1831), a German theologian, was born in Westphalia. In 1792 he studied theology at Münich, and in 1807 became professor of dogmatic theology in the university, and tried to carry out in a measure the principles of Kant, though he defended Christian dogma against them. In 1820 he became professor of Catholic theology at Bonn, and lectured with a view to reconciling Catholics and Protestants. His views took the name of *Hermesianism*, and his disciples started a magazine to embody them. In 1835 his views were condemned as heretical. He founded revelation on reason, but held that reason cannot prove dogmas. In 1819 he published *Philosophical Introduction to Christian Catholic Theology*.

Hermetic Books, the sacred canon of the ancient Egyptians, so called because they were supposed to have been composed by the god Thoth, "the scribe of the gods," who received from the Greeks the name of Hermes Trismegistus. According to Clemens Alexandrinus there were 42 such books divided into six sections. The first four treated respectively of (1) the nature of the gods, laws, the education of priests, (2) sacrifices, liturgical ceremonies, processions, (3) cosmography and geography, (4) astronomy and astrology; the fifth section included a collection of sacred songs, and an account of a ruler's life and duties; the sixth section was devoted to medicine. Some of the fragments preserved in Stobæus and other ancient writers are said to show traces of Neoplatonic influence. The *Book of the Dead* apparently belonged to the 2nd section; the Ebers papyrus, supposed to have been written about 1500 B.C., formed part of the sixth.

Hermit, or **EREMITE** (from Greek *eremias*, a desert), a name given originally to those who, amidst the moral decay of the Roman Empire, withdrew into the desert, hoping by a life of mortification to escape the expected judgment of God. During the fourth century hermit cells became common in the deserts first of all of Egypt and afterwards of Syria and Palestine. The most famous of these early hermits was St. Anthony (q.v.). The hermit life remained the ideal life of the Christian until it gave way to that of the convent.

Hermit Crabs, a general name to include the commonest of the Anomura, a division of the Decapoda (*Crustacea*) (q.v.), in which the abdomen is intermediate between the long-tailed form of the lobster and the short-tailed of the crab. There is, however, no doubt that this group is an artificial assemblage, including some of both the long-tailed (*Macrura*) and short-tailed (*Brachyura*) Decapoda. The Hermit Crabs are now assigned to the Macrura, as they have a fairly well-developed, though soft and unprotected, abdomen. As a consequence of this some protection is necessary, and is gained by the animal living inside an empty whelk shell. They are common on shell-banks all round the English coast.

Herne the Hunter, a legendary character who has long been connected with Windsor Forest. Shakespeare has immortalised him in the *Merry Wives of Windsor*, and Harrison Ainsworth has followed in the same track. His oak was blown down in 1863 after standing, it is said, for some centuries.

Hernia. The term hernia is applied to the condition, popularly known as "rupture," in which a portion of the abdominal contents (intestine or omentum) escapes from the cavity of the abdomen through some weak spot in its bounding wall. There are certain situations in which a hernia is especially liable to occur, either from some defect of development, in which case the malformation exists from birth and the hernia is said to be congenital, or from some anatomical peculiarity which leads to a liability to protrusion at certain points of the wall of the abdomen. Such situations are the inguinal canal (inguinal hernia), the crural canal (crural or femoral hernia), the umbilicus (umbilical hernia), and rarer forms are those known as obturator hernia, lumbar hernia, sciatic hernia, and diaphragmatic hernia. The parts of a hernia are first, the sac, consisting of peritoneum; second, the contents of the sac (usually small intestine); and third, the skin and other tissues covering the sac. Roughly speaking, out of every hundred cases of hernia 84 will be of the inguinal, 10 of the femoral, and 5 of the umbilical variety. The inguinal form is much more common in men than in women, while in femoral hernia the reverse is the case. The tendency to hernia may be inherited. The determining cause of the rupture may be some sudden act of exertion. Hernia is classified under five heads. (1) *Reducible* hernia. This is much the most common form, and derives its name from the fact that the contents of the sac can be readily displaced and returned into the abdominal cavity, i.e. reduced. In such a condition a rounded regular pear-shaped swelling is met with, in which a distinct impulse is felt when the patient coughs, and which can be made to disappear by gentle manipulation, particularly when the patient is lying down. (2) *Irreducible* hernia. Here the same characteristics are present, save that the contents of the swelling cannot be returned to the abdominal cavity. (3) *Incarcerated* hernia is a form of rupture in which the intestine occupying the hernial sac becomes blocked; the tumour cannot be reduced, the impulse on coughing is retained, and there is an absence of those constitutional symptoms which appear in strangulated hernia. (4) *Inflamed* hernia is the condition in which inflammation is set up in the tissues surrounding the protrusion. (5) *Strangulated* hernia. In this form of hernia there is an obstruction to the passage of the contents of the intestine through that portion of the canal which has escaped into the sac, and there is an obstruction to the blood supply of the prolapsed portion of gut. This state of things is generally brought about by a sudden increase in the extent of the protrusion caused by exertion. Strangulated hernia differs from the last-named varieties in that the impulse on coughing

is lost, and the condition is attended with grave constitutional symptoms, the most characteristic of which are pain, absolute constipation, and vomiting. If the circulation of blood in the prolapsed intestine be not speedily restored the constricted gut becomes gangrenous and sloughs. The treatment of reducible hernia is two-fold. The most common plan is merely palliative, and consists in the use of a truss. In some instances what is called a radical cure can be effected. In the irreducible form a *bag truss* may be employed, or more usually an operation is recommended with a view to effecting a radical cure. The treatment of the remaining varieties is a matter which cannot be here discussed, and in conditions of such gravity professional advice must, of course, be obtained without delay. It is most important that a patient should on no account neglect a rupture, as the use of a suitable truss from the outset may obviate the subsequent occurrence of any complication, and is in some instances in itself sufficient to produce complete cure of the condition.

Hero. 1. An ancient priestess of Aphrodite at Sestos in Thrace. Tradition says that Leander of Abydos, while present at a festival at Sestos, fell in love with the young priestess, and that his love was returned. He used to swim across the Hellespont to visit her, she meanwhile placing a lighted torch in a tower to guide his course. On one occasion the light went out, and Leander, missing his course, was drowned, and his body was washed to the foot of the tower. Thereupon Hero ascended the tower and, throwing herself from the top, died with her lover.

2. A mechanician and mathematician of Alexandria, who flourished about 215 B.C. He left two books on the construction of automata, published at Venice in 1601. Other works of his are lost or exist only in fragments. He is said to have made air machines, and engines for use in war, and to have made many discoveries in dioptrics. He also invented a steam-engine of a simple kind (q.v.), a double-force pump, and the contrivance which is called Hero's fountain (q.v.).

Hero-children, the name given by anthropologists to children of whom one parent was reputed to be divine (as Remus and Romulus), or whose births were attended with portents (as Cyrus), and who, on attaining manhood, became national heroes.

Herod the Great (73-4 B.C.) was the second son of Antipater the Idumean, who was Procurator of Judaea and made his son governor of Galilee. Herod in the civil troubles of Rome sided with Brutus and Cassius, but his talents led to his finding favour with Antony, who made him Tetrarch and King of Judaea, a position in which Augustus confirmed him after the downfall of Antony. Although a sound politician and a good general, he was a man of jealous nature and violent passions. He killed his brother Aristobulus, and Hyrcanus, the grandfather of his wife Mariamne, and finally killed her, the rest of her family, and his sons by her, so determined was he to have no rivals near

his throne. He displayed great magnificence in his surroundings, rebuilt the Temple, built a theatre and amphitheatre for Jerusalem, and rebuilt on a grand scale Samaria. He also erected strong fortresses in his dominions, of which Cæsarea was an example. Besides a fine palace at Jerusalem, he had a country house, the Herodeion. He incurred much odium by the massacre of infants at Bethlehem, another mark of his dread of rivalry; but, on the whole, he was a favourite with the Jewish nation, though they suffered from his despotism. In his later days disease made him, as later it did Henry VIII. of England, doubly vindictive, and one of his latest acts was one of almost humorous madness—namely, to summon the chief Jews to Jericho, leaving orders to Salome that they should be slain at his death in order that there should be some to mourn him, unless, indeed, he had deep motives of policy for the act as likely to paralyse any effort at revolt when his strong hand should be removed from the helm.

Herod Antipas, son of Herod the Great, was Tetrarch of Galilee. He it was who beheaded St. John the Baptist. He was dismissed from his rule by Caligula, and died in exile in France or Spain in 40 A.D.

Herod Agrippa I. was the grandson of Herod the Great, his mother, Bernice, being that king's daughter. Brought up with Drusus, he fell into disgrace with Tiberius, and therefore found favour in the eyes of Caligula. He died of a malady said to have carried off other tyrannical rulers of antiquity (Acts xii.).

Herod Agrippa II. was too young to exercise his father's power, so his charge was reduced to a province. It was before him and his wife-sister Bernice that St. Paul pleaded. He afterwards gave valuable aid to Titus in his schemes, and died at Rome A.D. 94.

Herodiones, in some classifications a group of birds corresponding to Huxley's Pelargomorphæ (q.v.).

Herodotus, "the Father of History," was born in B.C. 484 at Halicarnassus in Asia Minor. There was talent in the family, for his uncle was a poet. He soon set out on his travels, first visiting Egypt, then more than now the home of mystery, and just beginning to be opened to Greek curiosity, and passing on to Libya, Palestine, Babylon, Scythia, Thrace, Macedonia, and Epirus, and so home to Caria, where he found political disorder raging that drove him to the island of Samos. Returning to Halicarnassus, he with others drove out Lygdamis, who had usurped the supreme authority, but the succeeding aristocratic government was little better, and those for whom he had worked taunted him with doing them more harm than good. In disgust, therefore, he retired to the Greek colony of Thurii in Italy to find there the tranquillity which should enable him to carry out the great work of his life. Some say that he wrote his history at Halicarnassus, and read it at the Olympic Games in 456 B.C., so charming the audience that they applied the names of the Muses

to the different parts of his work, and so working on the emotions of Thucydides, then a boy of fifteen, as to make him weep, and determine him on the course of life-study which made him the other great historian of Greece. He is said to have read his history at Athens in 446 B.C., and to have received a prize of £2,500 for it. Pliny was of opinion that he wrote at Thurii, and completed his history to 409, but as it stands it ends very abruptly, and suggests that he died leaving it unfinished, early in the Peloponnesian war. Beginning with the struggle of the Greeks and Persians, the clashing of the East and West, Herodotus searches into the mythical stories of mutual outrage that led to the conflict. This carries him to Lydia, whose history he relates down to the fall of Croesus before the rising power of the Persians, and the subjugation of Asia Minor leads to the introduction of Babylon, and the life of Cambyses introduces Egypt, and that of Darius takes us among the Scythians. So the extension of the Persian kingdom leads to the treatment of Cyrene and Libya, and by a natural sequence of events we arrive at the Ionian revolt, and the struggle between Greece and Persia. Everywhere, however, there are minor digressions on the slightest provocation. No account can convey any idea of the simple charm of Herodotus' style to those who have not read him in the original, or at least in a good translation, and modern research (except perhaps in the case of Egypt) has amply vindicated his character for truthfulness in matters which came under his own observation. Some excellent editions of his history with valuable comments and illustrations have been issued, and among Englishmen the brothers Rawlinson have done much towards increasing our knowledge of the subjects of which Herodotus treated, and also of his own merits.

Heroes, in classic mythology, originally men distinguished above their fellows for strength, courage, or wisdom. Later it was fabled that such persons were partly of divine origin—Perseus was the son of Zeus, and his mother the mortal Danaë; Æneas was the son of Venus, and his father the mortal Anchises. Heroes were honoured with a cultus, generally local, and in some respects corresponding to the honour paid to Christian saints.

Heron, any bird of the genus *Ardea*, type of the family Ardeidae, allied to the Storks, but having a large hind toe, and the inner margin of the middle toe pectinated. There are four other genera: *Nycticorax* [NIGHT HERONS], *Tigrisoma* [TIGER BITTERNS], *Botaurus* [BITTERNS], and *Caroroma* [BOAT-BILL]. The true herons (*Ardea*) comprise about sixty species, and are cosmopolitan. Most of them are large birds with a thin body, long neck and beak, and more or less sombre plumage, though in the egrets (sometimes made a separate genus, *Herodias*) it is white. The common heron (*A. cinerea*) ranges from Britain, through Europe, to Eastern Asia. It is about three feet long, bluish-grey above, white beneath, the breast black, with a white patch in front; the throat is white, streaked with black, the colour of the quill feathers;

the tail slate-colour; and there is a pendant black crest. They are usually solitary, except at the breeding season, when numbers of them nest together. *A. purpurea*, the Purple Heron, a rare British visitor, is from Central, and *A. equinocialis*, the Buff-backed Heron, from Southern Europe. The Green Heron (*A. viridis*), the Great Blue Heron (*A. herodias*), and the Great White Heron (*A. occidentalis*) are American. Probably the largest species is the Goliath Heron (*A. goliath*) from Africa. The Peacock Heron, or Sun Bittern (*A. helius*), from South America, where it is often kept as a pet, is of small size and variegated plumage. The Great Egret (*A. alba*) and the Lesser Egret (*A. garzetta*), formerly a native, occasionally stray to Britain.

Hero's Engine, made first by the ancient philosopher of that name, is a steam-engine working on the principle of Barker's mill (q.v.), but forcing steam out of lateral jets in the vessel instead of water. The momentum of the issuing steam causes a retrograde rotation of the vessel which is pivoted so as to move with freedom. *Hero's Fountain* is a contrivance for forcing a small jet of water into the air by means of compressed air, the compression being produced by a difference of water-level.

Herpes, a vesicular affection of the skin. The blisters or vesicles of herpes vary in size from that of a pin's head to that of a split pea. They are usually distributed along the course of distribution of some nerve. In the common form known as "shingles," one of the cutaneous branches of an intercostal nerve is involved. Herpes also sometimes affects the lips, the neck, or one of the limbs. The eruption is sometimes attended by pain. After the lapse of a few days the blisters dry up, scabs are formed, and the disease is at an end. No treatment is called for beyond protecting the affected parts; this result is best attained by painting them all over with a solution of collodion.

Herrera, FERNANDO DE (1534–1597), a Spanish poet, commonly called "El Divino," was born at Seville. His style was formed on classic and Italian models, and his works consist chiefly of odes and love poems. He also wrote much in prose, but several of his works are lost. There are two editions of his poems (1581 and 1619), but they are seldom to be met with. Among his prose works is a narrative of the wars of Cyprus.

Herrera, FRANCESCO (circa 1576–1656), a Spanish painter of the Seville school, known as "El Viejo," to distinguish him from a son, also a painter of some note, and the founder of a new and powerful school of painting. Among his best works are *The Last Judgment* and a *Holy Family*, both in churches in Seville. He also adorned the dome of St. Bonaventura with fresco, and was renowned as a painter of common life and for bronze-work, statuary, and architecture. Some of his best works are in the Louvre.

Herrick, ROBERT (1591–1674), an English poet, was born in London, where his father was a goldsmith, and educated at Cambridge. He came

to London in 1620, and there made the acquaintance of Ben Jonson and his circle; but in 1629, apparently against his taste, he took orders, and was relegated to an out-of-the-way living in Devonshire, where, nevertheless, he seems to have worked well and to have been appreciated. From 1647-62, during the Puritan ascendancy, he was in London, returning afterwards to his parish. His poems were published in one volume, containing the *Hesperides* and some half-hearted religious poems called *Noble Numbers*, though even in these latter there are some noble pieces. But it is the former that show the great charm of his manner, which is almost Shakespearean. *Oberon's Feast*, *Oberon's Palace*, *Gather ye Rosebuds*, *Cherry Ripe*, *Bid me to Live*, and the like, are universally known and as widely admired.

Herring, a book name for the Physostomous Teleosteian family Clupeidae, dating back to the Chalk formation. The body is covered with scales, the head is naked, and barbels and adipose fin are wanting. The single dorsal is short, and the anal fin is also single. The stomach is furnished with a blind sac, and the pyloric appendages are numerous. The gill-openings are generally very wide, and the air-bladder is more or less simple. The Clupeidae are principally coast fishes, widely distributed in temperate and tropical seas. The type-genus Clupea has more than sixty species, with the distribution of the family. The body is compressed, and the abdomen is serrated as far as the thorax. The anal fin is of moderate size, and the dorsal is opposite to the ventrals. To this genus belong the Common Herring (*C. harengus*), the Shads (*C. alosa* and *C. finta*), the Alewife (*C. mattanoca*), the Pilchard (*C. pilchardus*) and the Oil Sardine (*C. scombrina*), with many others economically important for food, or as yielding oil. Some of the tropical forms are more or less poisonous if eaten. The common herring may be easily recognised by its smooth gill-cover and the ovate patch of minute teeth on the vomer. It is found in vast numbers in the North Sea, the northern parts of the Atlantic, and the seas to the north of Asia. The herring fishery is a very important one, especially on the British, Norwegian, and Dutch coasts, and commences when the fish come into shallow water to spawn. This season varies in different places. In the outer Hebrides the fishery is forbidden by law before May 20th, but in the Shetland Isles it rarely commences before July. Off the west coast of England herrings are plentiful in October and November, and they appear to spawn off the south coast in January only. August and September are the best months at Yarmouth, the headquarters of the fishery in England and the seat of the trade for curing herrings.

Herschel, Sir John (1792-1871), an English astronomer, son of Sir William Herschel, was born at Slough, and educated at Eton and Cambridge. In 1813 he graduated B.A., as Senior Wrangler and Smith's prizeman. In 1820 he published a work on the application of the calculus to Finite Differences. In 1822 his father died, and he

thenceforward applied himself to astronomy, among his first works being an examination and description of the nebulae and clusters discovered by his father. In 1823 he wrote the article on Physical Astronomy for the *Encyclopaedia Metropolitana*, to be followed up at intervals by other articles in that and other cyclopedias. Articles on sound and on the theory of light had already appeared in the above-mentioned encyclopedias. From 1834-37 he was at the Cape in order to study the stars of the Southern Hemisphere, and the results of his expedition were published in 1848 at the expense of the Duke of Northumberland. In 1838 he became D.C.L. of Oxford and baronet, and in 1848 President of the Royal Astronomical Society. From 1850-55 he was Master of the Mint. Besides his astronomical pursuits, he found time to write poems, and in 1866 he published a translation of the *Iliad* in hexameters. His articles to the *Edinburgh and Quarterly Reviews*, and addresses to the Astronomical Society and the British Association, were published in 1857.

Herschel, Sir William (1738-1822), was the son of a Hanoverian musician, and at fourteen entered the band of the Hanoverian Guards. In 1757 he came to England, and was commissioned to form a military band, and did duty as an organist at Bath, where he also conducted concerts. He gave his leisure to mathematics and astronomy, and set about making a telescope of five feet, which he finished in 1774, going on to construct others of seven, ten, and even twenty feet. He gradually withdrew himself from the musical profession, and in 1779 began to observe, with his 7-in. telescope, the planet *Uranus*, at first called Georgium Sidus, in honour of the king, who granted him a pension. In 1787 he finished his forty-feet telescope, and his observations with this led to many notable discoveries, among them being the discovery of volcanic mountains in the Moon, Saturn's satellites, and those of Uranus, the rotation of Saturn's rings, of Saturn, and of Venus, the existence of binary stars, and some facts as to Ceres, Pallas, Juno, and Vesta. He was aided in his work by his sister CAROLINE, herself no mean astronomer, and by his brother, an optical-instrument maker. In 1802 he put before the Royal Society a catalogue of 5,000 new nebulae, clusters, etc. His merits were recognised by the bestowal of knighthood and the degree of D.C.L.

Herschel Telescope is a special form of reflecting telescope, possessing the advantage of great simplicity, but only adapted for large instruments and for observation of nebulae or of such other objects as chiefly require light-giving power. The large concave reflector is placed at the end of the tube, so that light from the heavens is reflected back; a slight tilting is given to the mirror, so that the reflected image is brought to one side of the tube, and the observer introduces his head actually into the tube to examine this image. The amount of light intercepted by his head is a fatal objection if the aperture of the telescope is small. Herschel's instrument of 1789 had a four-feet aperture. The obliquity of the mirror spoils the definition of the

image, and heat from the body of the observer is also found to introduce difficulties. [TELESCOPE.]

Hertford, market town and capital of Hertfordshire, on the Lea, nineteen miles north of London, and on the Great Northern and Eastern Counties railway systems. It consists of three principal streets meeting in a central square. It possesses a free library, shire hall, corn exchange, free grammar school, county and borough police offices, and infirmary, and there are several almshouses and other charities. The chief industries are malting and brewing, trade in corn, coal, and timber, and there are oil and flour mills, some of the latter being on the Lea. Hertford is a place of some antiquarian interest, a national ecclesiastical council having met there in 673, and a Saxon king having built there a castle, afterwards inhabited by John of Gaunt, the queen of Henry IV., V., VI., and Elizabeth. Here John of France and David of Scotland were imprisoned. Pop. (1901), 9,322.

Hertfordshire, an inland county, having Cambridge on the north, Middlesex on the south, Essex on the east, and Bedford and Bucks on the west. It is 38 miles long from S.W. to N.E., by a width of 20 miles, and contains 405,000 acres, of which 350,000 are arable, meadow, or pasture. The surface consists of hill and valley, the chalk hills of the north rising to a height of 900 feet, and there is much wood, and abundance of parks and seats. The climate is agreeable. The soil is for the most part loam and clay, but the centre is in places gravelly. Most of the cultivated land is arable, the chief crops being good wheat and barley, oats, turnips, and grasses; and the meadows produce good hay. In the S.W. there are cherry and apple orchards. There is not much live stock, and the sheep are mostly of Southdown and Wiltshire breeds. The chief industries are malting, paper-making, straw-plaiting, and ribbon-weaving. There are four parliamentary divisions, returning one member each. The four northern railways provide railway accommodation for the county. Pop. (1901), 250,350.

Hertz, Henrik (1798-1870), a Danish poet, was born at Copenhagen. In 1817 he entered the university as law-student, but soon gave himself to literature. His earlier works were anonymous, and consist of comedies, a vaudeville, and a satire which made some commotion. In 1833 he went, by aid of a travelling pension from the Government, to Italy, France, and Germany, entering on his return upon an active literary life. Besides many other works, both comedies and tragedies, he wrote several novels. Theodore Martin translated his *King Ren's Daughter*.

Hertzian Oscillations. Of recent years Maxwell's theory of the electro-magnetic ether has been gaining considerable ground, both experiment and calculation confirming the statement that radiation through the ether is of the same nature, whether it manifest itself as light energy, heat energy, or electrical energy. [MAXWELL'S THEORY.] The only important difference that exists between these kinds of radiation is that, while all are wave-motions of some sort, the waves are not all of the

same length and frequency. Those oscillations due to electrical displacements, frequently called Hertzian oscillations, are of greater wave-length and less frequency than those due to the passage of what is called red light, and these latter again are of greater wave-length and less frequency than those due to violet light. Inasmuch as the eye is only capable of distinguishing waves of such frequencies as lie between the red and violet limits, it cannot recognise electro-magnetic radiation, which therefore requires another sense to distinguish it. The case is similar to that of a vessel of hot water in a dark room; this is radiating dark heat, indistinguishable to the eye but readily detected by the sense of touch. Dr. Hertz of Carlsruhe has succeeded in showing experimentally that electrical oscillations may be transmitted through a suitable dielectric or non-conductor, and that the waves thus produced may be reflected from or refracted through plane or curved surfaces in precisely similar fashion to the reflection or refraction of light-waves. [LIGHT, RADIATION.]

Hervey, James (1714-58), an English clergyman and author, was born near Northampton, and was educated at Oxford. He took orders, and was appointed curate of Dummer in Hampshire in 1736. In 1738 he went to Stoke Abbey, Devon, and here it was that he planned the *Meditations* by which he is chiefly known, and which were composed among the tombs of a Cornish churchyard. His works were published in six volumes, and his letters and memoir in 1760.

Herz, Henri, pianist and composer, was born at Vienna 1806, and, after studying at Paris and visiting England and America, was professor of music at the Conservatoire of Paris (1842-74). He was also a successful piano-maker. He died in 1888.

Herzen, Alexander (1812-70), a Russian writer, was born in Moscow, and educated at the university there, where he imbibed philosophical and socialistic views. In 1834 he was imprisoned for joining in a song against the emperor, and was banished to Siberia. By the intercession of the Grand Duke Alexander he was allowed to live at Vladimir, and in 1839 he was set free, and was appointed secretary to Count Stroganoff, Minister of the Interior. His advanced views again displeased the Government, and he was sent to Novgorod, where he was made Imperial Councillor. The death of his father in 1847 gave him the means of obtaining leave to travel, and he left Russia for ever. He visited Italy, France, England, and Switzerland, and died at Paris. He was patriotic, and devoted to the advancement of the Slavonic races. In 1857 he started a journal *Kolokol*, in London, removing it afterwards to Geneva. Among his works were letters, novels, memoirs, and translations.

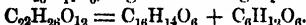
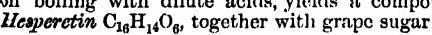
Hesiod, one of the earliest of Greek poets, was born at Oyme in Æolia. As a boy he went to Ascra in Boeotia, whence he is sometimes called "the Ascraean," and is said in later life to have practised divination in Acarnania and to have been a priest

in the temple of the Muses at Mount Helicon. He afterwards went to Locris, where he was murdered and thrown into the sea; but dolphins brought his body to the shore, thus leading to the discovery and punishment of his murderers. His date is unknown, but is sometimes put at 900 B.C. His works are the *Theogony*, a history of the origin and deeds of the gods. Fragments, too, exist of a work called *The Shield of Hercules*, which was probably part of a larger work; but the *Works and Days*, an epic dealing mainly with rural life, is the best known of all his productions, and was by the Boeotians considered the only genuine one of those attributed to him. This has been translated into English verse and prose.

Hesperide, a family of butterflies known as the "Skippers," the members of which occur mainly in tropical America. There are seven English species, of which *Pamphita sylvanus* (Linn.) is one of the largest. The "Lulworth Skipper" is of interest only owing to its occurrence at but one locality. The popular name is derived from their brisk, jerky flight.

Hesperides, THE, were in Greek mythology the guardians of the golden apples which Ge gave to Hera. They were, according to Hesiod, "daughters of the night," according to other accounts daughters of Atlas, or of Zeus and Themis, or Ceto and Phorcys. Their names also differ according to different legends, but those generally adopted are Ægle, Arethusa, and Hesperis. The garden containing the apples was in an island of the ocean near the Hyperborean Atlas. They were aided in their task of guardianship by the dragon Ladon. This dragon Hercules killed, and, having taken the apples, he gave them to Athene, who afterwards restored them to the sisters.

Hesperidine, a compound $C_{22}H_{28}O_{12}$ which occurs in unripe oranges, lemons, and other fruit. It forms a white, tasteless, insoluble powder, which, on boiling with dilute acids, yields a compound,



Hesperidium, so named from the legend of the golden apples of the Hesperides, is the technical term for the fruit of the orange tribe, a superior polycarpellary syncarpous succulent fruit, belonging to the nuculane type. It has a leathery epicarp, studded with oil-glands, a white woolly mesocarp and a thin membranous endocarp dividing the numerous carpels, which are each usually two-seeded. From the inner surface of this endocarp are produced rows of large spindle-shaped cells, filled with watery acid or sub-acid juice, which fill the carpels as the pulp of the fruit.

Hesperornis, a genus of fossil birds, including several species, described by Professor O. C. Marsh, from the Middle Cretaceous rocks of Western Kansas. They were huge fish-eating Divers, nearly six feet high, with a perfectly flat breast-bone, without a vestige of a keel, and there were apparently not even rudimentary wings. The tail is elongated, somewhat as in *Archæopteryx* (q.v.),

and the long jaws are armed with numerous teeth in a common groove as in *Ichthyosaurus*.

Hesse, formerly a district of Central Germany, in Roman times the home of the Teutonic tribe of Catti, whose chief town, Mattium, was destroyed by Germanicus. Under the Frankish kings it was governed by counts, and in the Middle Ages it formed part of Thuringia, belonging in 1263 to Sophia, wife of Henry of Brabant. With her son Henry began the dynasty of Hesse, which later split into four branches, which by failure of issue diminished to two in the early part of the 17th century. From these two came the divisions Hesse-Cassel and Hesse-Darmstadt. The former, now almost absorbed into the Prussian province of Hesse-Nassau, was founded in the 16th century by the Margrave William IV. It sided with Austria in 1866, and was annexed. Hesse-Darmstadt is a Grand Duchy, partly drained by the Eder and Fulda into the Weser. Much of it is cold and unproductive, but the climate of the river-valleys is mild and pleasant, and the vine is extensively cultivated, together with much fruit, corn, hemp, flax, potatoes, rape-seed, tobacco, and hops. There is also much forest land. Agriculture and cattle-rearing are the chief industries, and horses, cattle, sheep, and swine are abundant. Linen is manufactured, and salt, basalt, whetstones, lime and sandstone are quarried. The chief towns are Darmstadt (capital), Mainz, Giessen, Bingen, and Worms.

Hesse-Nassau is a Prussian province made up of the greater part of Hesse-Cassel, part of Hesse-Homburg on the W. of the Rhine, most of the ancient duchy of Nassau, small parts of Hesse-Darmstadt and Bavaria, and the territory and town of Frankfurt, containing in all 6,018 square miles, divided into the government of Cassel, which nearly corresponds with Hesse-Cassel, and contains 3,914 miles, and that of Wiesbaden, which nearly corresponds with the Duchy of Nassau, and contains 2,104 miles. The country is generally rugged, and is occupied in the north by the Harz Mountains, which rise to a greatest height of 3,600 feet. It is drained by the Fulda, Werra, and other rivers flowing into the Weser, and the Lahn, Ohm, and Main flowing into the Rhine. The climate of the higher regions is severe, but in the Rhine valley the best German wines are produced. Three-fifths of the soil in the valleys and mountain slopes is arable, and there is an improving agriculture, though some of the soil is poor, that of Nassau being the best. Potatoes are largely cultivated and used for food, and there is much barley, rye, and oats. Fruit is tolerably abundant, and the forests are extensive. Woolen, cotton, and linen are manufactured, and there are some minerals, while Homburg and Wiesbaden are noted for their mineral waters. The chief towns are Cassel (capital), Wiesbaden, and Frankfurt.

Hessian Crucible. [CRUCIBLE.]

Hessian Dyes. A number of dyes are known under the names of Hessian purple, and compounds termed Hessian-violet and Hessian-yellow are also used as colouring materials. They are all

compounds of very complicated structure, and are derivatives of a hydrocarbon of composition $C_{14}H_{12}$ known as *Stilbene* (q.v.).

Hessian Fly, a small brown fly known as *Cecidomyia destructor* (Gay), and belongs to the family *Cecidomyidae*. It deposits its eggs on wheat plants. The maggots, when hatched, work their way down to the base of the leaves and there feed on the sap. Many authorities believe it was carried to America by the Hessian troops during the War of Independence, whence its popular name. It now does serious damage in that country.

Hesychius, a grammarian of the fourth century A.D., is supposed to have been a native of Alexandria. He produced a *Lexicon*, partly original and partly compiled from older ones. It is considered the best of the early lexicons, and has great antiquarian value. A good edition was published at Leyden in 1746-66, and the supplements of Schow, Leipzig (1792), and of Schmidt, Jena (1857-64), are of value.

Heterocera, the division of insects including the Moths (q.v.).

Heterocercal. [FISHES, vol. iv. p. 305.]

Heterocolla, a division of the calcareous sponges, including those in which the collared cells are restricted to ampullæ or special cavities. [HOMOCOLA.]

Heterocism, in fungi, or other parasites, is the passing different stages of development on distinct hosts. A striking instance is the corn-mildew (*Puccinia graminis*), which at one stage is known as the cluster-cup of the barberry, formerly named *Aecidium berberidis*, whilst other stages, one once named *Uredo*, and the other and final one known as *Puccinia*, occur on wheat or some other grass.

Heterogamy, a method of reproduction met with in some insects; it unites parthenogenesis (q.v.) with alternation of generations (q.v.).

Heterogony. [HETEROSTYLY.]

Heteromorphæ, in Huxley's classification, a group of birds containing the Hoazins. [HOAZIN.]

Heteromya, a subdivision of the bivalve molluscs (*Lamellibranchiata*) in which the shell is closed by two adductor muscles, of which the anterior is much the smaller.

Heteropoda, a subdivision of the Gastropoda (q.v.) in which the foot is modified to form a swimming organ.

Heteroptera, a division of Rhynchota (q.v.), including those with the anterior pair of wings membranous at the ends but hard and chitinous at the base, known as hemelytra (q.v.). The group is divided into two subdivisions—the Water-bugs (*Hydrocorisæ*), and Land-bugs (*Geocorisæ*). The best-known forms are the Water-measurers (*Hydrometra*), Water-scorpions (*Nepa*), etc.

Heterospory, the production by the same plant of two different kinds of spore, as opposed to homospory or isospory. The term is chiefly employed with reference to the Pteridophyta (q.v.), and the distinction was until recently used as the

fundamental basis for the subdivision of that sub-kingdom. It is now recognised, however, that there are four natural classes in it: the Filicinæ, including the homosporous ferns and the heterosporous Rhizocarps (q.v.); the Equisetinæ, including the homosporous horsetails (q.v.), and the heterosporous fossil *Annularia* and *Calamites* (q.v.); the heterosporous fossil *Sphenophylleæ*; and the Lycopodinæ, including the homosporous *Lycopodium* and the heterosporous *Selaginella*, living, and *Lepidodendron*, fossil. Heterospory seems, therefore, to have originated several times independently. As it would seem to be the higher type, its abundant representation among Palæozoic plants is remarkable.

Heterostyly, or HETEROGONY, the possession of stamens and styles of different relative length in different flowers of the same species. In primroses and their allies *dimorphic* heterostyly occurs, one form, the *long-styled* or *pin-eyed*, having the stigma at the top of the corolla-tube and the stamens half-way down it, whilst in the other, the *short-styled* or *thrum-eyed*, their positions are reversed. The common purple loosestrife, *Lythrum Salicaria*, is an example of *trimorphic* heterostyly, *long*-, *medium*-, and *short-styled* forms occurring, each with two rows of stamens of lengths other than that of its own style. Darwin first showed heterostyly to be an adaptation to cross-pollination by insect-agency, corresponding parts of an insect's body touching the anthers of one flower and the stigma of another, whilst the pollen from any other was *prepotent* on the stigma at a similar level.

Heterotrichia, an order of Infusoria (q.v.), characterised by the cilia occurring as an investment to the whole body, while around the peristome (or mouth) there is a circle of longer cilia.

Hewett, SIR WILLIAM NATHAN WRIGHTE, naval officer, was born in 1834, and served in the Burmese War of 1851, in the China War of 1857, and on shore before Sebastopol. Promoted to be captain in 1862, he was commodore on the coast of Africa during the Ashantee War. He was rear-admiral 1878, vice-admiral 1884; he died in 1888.

Hexacoralla, a group of corals (q.v.) of the class Madreporaria (q.v.), including all those "true corals" in which the septa are either six or are arranged in multiples of six. The group is divided into three orders, the Perforata, Fungida, and Aporosa. In the former the skeleton is loose and porous in texture as all the solid parts are perforated by numerous pores. *Madrepora*, of which the well-known stag's horn coral is a familiar example, is the principal genus of the Perforata. The Fungida are characterised by the possession of "synapticulae"—small rods passing from the septa into the body chambers on each side. The mushroom coral (*Fungia*) is the type of this group. The Aporosa is the largest order; the calcareous structures are here solid. This includes the astrean corals, such as the Brain coral, and most of the simpler single corals such as *Flabellum*. Another classification has been prepared, based on the origin of the body wall, but so far it has not been

sufficiently worked out to be accepted here. The Hexacoralla is the largest existing group of corals. It is probable that most of the Palaeozoic "Rugose" corals ought to be included within it.

Hexactinellidae, a group of sponges having a siliceous skeleton composed of spicules, which are either united by the type (*Dictyonina*), or which are separate from one another (*Lysakina*). The spicules are six-rayed, and through the centre of the rays run three transverse canals. A series of many-rayed "flesh spicules" also occurs. The group is of great interest as, with very rare exceptions, it is at present limited to the deep seas, while in former periods it was very widely distributed. Thus many of the sponges of the Chalk or of the Lower Greensand sponge banks belong to this group, while it is known in the Palaeozoic. The best known recent member of the group is the "Venus Flower Basket" (q.v.), or *Euplectella*, which is a member of the Lysakina. *Hyalonema* is another well-known form. It is surrounded at the base by a tuft of glass-like fibres, whence it has gained its name of the "Glass-rope Zoophyte." These anchoring fibres have long been known from the Carboniferous. *Hyalonema* was once regarded as a coral.

Hexagon, in geometry, is a six-sided figure. A regular hexagon has six equal sides, consecutive pairs of which contain six equal angles. The opposite sides of a regular hexagon are parallel, and can only be regarded as meeting at an infinite distance. The three pairs of opposite sides of any hexagon inscribed in any conic section intersect in three points which will always lie in a line. This is Pascal's theorem. Further, the three diagonals of a regular hexagon—i.e. the lines joining opposite angular points—pass through one point. If any hexagon be circumscribed about any conic the three diagonals will also be found to intersect at a point. This is Brianchon's theorem. [DUALITY, PRINCIPLE OF.]

Hexameter (Greek, *hex*, "six," and *metron*, "a measure"), a form of verse much used by the Greeks and Romans, especially in epic poetry. It is the metre of Homer's *Iliad* and *Odyssey*, and of Virgil's *Aeneid*, *Georgics*, and *Elegies*. In classical prosody the structure of verse was not regulated, as it is in modern poetry, by the *stress* or *emphasis* laid on words and syllables, but by quantity—i.e. by the shortness or length of the vowel in each syllable. A hexameter line was composed of dactyls (a long syllable followed by two short ones) and spondees (two long syllables), and contained six feet, of which the last was always a spondee and the last but one almost always a dactyl. Some attempts have been made to write English and German hexameters, substituting stress for quantity. Those of Longfellow in *Evangeline* and *Miles Standish* are among the most successful. The following line is from *Evangeline*:—

When she had | passed, it | seemed like the | ceasing of |
exquisite | music.

Hexameters alternating with pentameters (q.v.) form elegiacs, which were often employed by the Greeks and Romans in lyric poetry. The attempt

to translate Homer in hexameters was ridiculed by Lord Tennyson in burlesque elegiacs (which in quantity conform strictly to rule):—

"These lame hexameters the strong-wing'd music of Homer!
No—but a most burlesque barbarous experiment.
When was a harsher sound ever heard, ye Muses, in England?
When did a frog cooer croak upcn our Helicon?"

Hexanes are hydrocarbons of composition C_6H_{14} belonging to the group known as paraffins (q.v.). Five different hexanes are theoretically possible; of these four are known, one occurring in petroleum. They are all liquids, of boiling-points varying from 43° to 71° . The corresponding alcohols $C_6H_{14}O$, of which eight are known, are termed *hexyl* or *capryl* alcohols. Seven acids derived from them have been prepared, known as *caproic* or *hexoin* acids, with formula $C_6H_{11}-COOH$.

Hexaprotodon, a fossil ungulate mammal with six incisor teeth, apparently a generalised ancestral form of the Hippopotamus family. It occurs in the older Pliocene rocks of the Siwalik Himalayas.

Hexham, a market-town of Northumberland, on the north bank of the Tyne, near the junction of the North with the South Tyne, crossed here by a stone bridge, 20 miles west of Newcastle, and on the Newcastle and Carlisle railway. The streets are mostly narrow, but there is a large market square containing a Moot Hall, once the courthouse of the Bishop and Priors of Hexham. Only the transept and chancel of the old cruciform abbey church remain. Other public buildings are a free grammar school and an institute. The trade is chiefly local. The town is of great antiquity, being supposed to be the Roman Alexodunum. In the 7th century a monastery was founded here by St. Wilfrid, and the Scots burnt the town in the reign of Edward I. In 1761 there was a formidable and fatal riot arising out of the militia ballot. Pop. (1901), 7,071.

Hexoses. [GLUCOSES.]

Heyne, CHRISTIAN GOTTLÖB (1729-1812), German philologist and antiquary, was born at Göttingen. His parents were poor weavers, and he suffered much from poverty during his university career at Leipzig. He made great progress in law and the classics, and was appointed librarian to Count de Dröhl, going to Dresden, where he came in contact with Winckelmann. The Seven Years' War brought him misfortune, but in 1763 he received an appointment at Göttingen as professor of eloquence. He founded a Society of Sciences, and managed well a philological seminary. He illustrated grammar and criticism by means of archaeology and history, and both his teaching and his writings had great influence upon classical studies in Germany. He read the classics as a means of understanding ancient life and history. He issued no great original works, but many good editions of classical authors, notably Virgil.

Heyse, JOHANN LUDWIG PAUL, perhaps the greatest of living German novelists, was born in Berlin 1830. He was patronised by King Max of Bavaria, and became a prolific writer. Besides his

narrative and epic poems, he has written many plays, some of which have been successful, and many novels and novelettes, and has translated much from Italian authors. Among his novels are *Die Kinder der Welt*, and *Im Paradiese Meraner Novellen*; and *Das Buch der Freundschaft* contains many slighter novels, while *Ulrica, die Braut von Cyborn*, and *Thelma* are good specimens of his poetry.

Heywood, a municipal borough of Lancashire, on the Roach, eight miles N.W. of Manchester. It is important for its cotton manufacture, all branches of which are carried on, and the manufacture of power-looms, iron and brass founding, and boiler-making employ many of the inhabitants. Pop. (1901), 25,461.

Heywood, JOHN (*circa* 1500-66), an English dramatist, was born probably at St. Albans, and was educated at Oxford. He made the acquaintance of Sir Thomas More, and was by him introduced to the Princess Mary, becoming a favourite at Henry VIII.'s court and at that of Mary I. After her death he retired to Malines, where he died. He is notable as marking the transition from the old miracle plays to the Elizabethan drama. He wrote plays and poems, and made a collection of proverbs. His earliest play was printed in 1533, and was entitled *The Pardoner and the Friere: the Curate and Neighbour Pratte*. Another work was the *Spider and Fly*, a parable. An edition of his works was issued in 1562.

Heywood, THOMAS (fl. 1600-1630), a dramatist of the times of Elizabeth, James I., and Charles I., was born in Lincolnshire and educated at Cambridge. He wrote wholly or in part 220 plays, of which 24 are extant, and he ranks high among the play-writers of his time. Two of his best-known plays are a *Woman killed with Kindness*, and *Poor London's Prentices*. In 1856 J. Payne Collier issued in two volumes an edition of his works, with a life and remarks on his writings.

Hezekiah, the 12th King of Judah, reigned about 726-928 B.C. He succeeded his father Ahaz at 25, and, led by Isaiah, inaugurated a series of reforms, abolishing idolatry, and endeavouring to restore national independence and prosperity. He repaired and reopened the Temple, and abolished idolatry. He waged a successful war against the Philistines, but, failing to pay the tribute due to Assyria, he was besieged. Soon after this he was seized by a severe illness, and, after his recovery, incurred the anger of Isaiah by showing his treasure to the Babylonian envoy who had come to congratulate him on his restoration to health. To resist Sennacherib he made an alliance with Egypt for the sake of the cavalry possessed by that power (or so it was alleged by Sennacherib's emissaries). It was during this war that the Assyrian host was destroyed by a mysterious pestilence. Hezekiah also executed many public works, among them aqueducts at Jerusalem, and died at the age of 54, after a reign of 29 years.

Hibernation, the term used to denote the intermittent or continuous winter sleep, of some animals in arctic, sub-arctic, and temperate regions.

Hibernation is applied to the summer sleep of some intertropical animals, e.g. of the tanrec (q.v.), which indulges in a three months' nap in the hottest weather.

No bird hibernates, and this fact probably led to the somewhat hasty conclusion that hibernation was Nature's substitute for migration; but not only do some mammals migrate, but hibernation occurs in groups where migration also takes place—among the rodents—and the bats, with powers of flight almost equal to those of birds, are among true hibernators. The phenomenon seems to depend chiefly on two factors: the failure of the food supply and low temperature. But since these are not sufficient to account for all cases of hibernation, some other factor or factors must be sought before the true explanation can be arrived at.

That the failure of food supply in winter has a great deal to do with the matter is shown by the fact that a series of examples among the rodents can be cited ranging from the food-storing habits of the long-tailed field-mouse (*Mus sylvaticus*), which does not hibernate, through the squirrel (*Sciurus vulgaris*), which hoards and hibernates partially, coming out of its hibernaculum, or winter quarters, frequently when there is a break in the cold weather, and the dormouse (*Myoxus arellanarius*), which also hoards, and sometimes wakes up, only to go to sleep again directly after a hearty meal, to the true marmots, which do not lay up a store of food, but retire to their burrows on the approach of winter and sleep till the return of spring. The badger and the hedgehog also hibernate. Bears are among true hibernators; many of them indulge in a prolonged winter sleep, but none lays up a store of food. According to Sir John Richardson, no bear retires to its den for the winter till it is fat, and, though it comes abroad in good condition in the spring, in a few days it loses the fat, and becomes quite lean. The Polar bear does not hibernate, but females with young retire to a den or cave and remain there from the end of November till about the end of March, when they come forth with their cubs.

In some of the lower vertebrates and in some invertebrates there is a lowering of vitality resulting in a kind of torpor in cold weather. This occurs in reptiles, amphibians, and many fishes, and some aquatic molluscs in winter bury themselves in the mud, emerging therefrom in the spring.

Hibiscus, a large genus of exotic Malvaceæ, most tropical trees or shrubs. Their flowers are large and showy, borne singular, each having an epicalyx of many leaves, five united and persistent sepals, five petals united at the base to the staminal tube, and five many-seeded carpels with distinct styles. *H. cannabinus*, Indian hemp or bastard jute, yields a useful fibre, and resembles hemp in foliage and mode of growth. Its petals are pale yellow with a purple blotch at the base. *H. rosa-sinensis*, a tree with large, variously-coloured flowers, has an astringent purple-black juice in its petals, used as a hair-dye in China and as blacking in Java. It is a greenhouse favourite; as also is *H. syriacus*, a shrubby autumn-flowering species

commonly known as *Althaea frutescens*. The Gombo (*Abelmoschus* or *Hibiscus esculentus*), with edible fruits, is closely allied.

Hiccough is produced by involuntary contraction of the diaphragm accompanied by spasm of the glottis. A series of contractions usually occur at short intervals each accompanied by a characteristic sound, due to the closure of the glottis, and after the lapse of a few minutes the attack of hiccough comes to an end; if it is more persistent it may usually be checked by repeating the act of swallowing several times in succession, or even by holding the breath in some cases. In some forms of disease obstinate hiccough occurs; this condition is fortunately a rare one, as it is most distressing and but little can be done to relieve it.

Hickory (*Carya*), a genus of trees, comprising about a dozen species, belonging to the walnut family and native to North America. They differ from the true walnuts in their male catkins being borne three together; in each flower having not more than six stamens; in the female flowers having no corolla, and a sessile four-lobed stigma; and in the outer part of the fruit splitting regularly into four valves. The hickories reach a large size and yield coarse-grained, strong, heavy and very elastic timber, largely used for barrel-hoops, whips-handles, axe-handles, chair-backs, musket-stocks and fuel, but not very durable. *C. alba*, the shell-bark or scaly-bark hickory, yields the best timber and the edible nuts known as hickory-nuts. *C. oliveiformis* is the source of the much superior Peccan nut, but even this is not equal in flavour to a walnut.

Hicks, Sir Baptist, Bart., created Baron Hicks and Viscount Campden in 1628, was born in 1551. Through his connection with the Court under Elizabeth, James I., and Charles I., he prospered exceedingly, combining mercery with money-lending. He built at his own charge the old Clerkenwell Sessions House, long known as Hicks' Hall, and through his daughter's marriage became an ancestor of many existing peers. He died in 1621.

Hicks, Elias, was born in Long Island, U.S.A., in 1748, and brought up as a carpenter. Under the influence of strong religious convictions he joined the Society of Friends, becoming an eloquent preacher and able organiser. Towards the end of his life he adopted independent views as to the Divinity of Christ, and founded a new sect called the Hicksites, dying in 1830.

Hicks, William, Colonel, known as **Hicks Pasha**, was born in 1830, and entered the Bombay army at the age of nineteen. After active service in Beloochistan, the Punjab, Rohilkund, and under Lord Clyde during the Mutiny, he took part in the Abyssinian campaign of 1867-68. Baker Pasha selected him as chief of the staff in 1883, when organising an expedition against the Mahdi. In September of that year he set out with 10,000 men on his march from Om-Durmah to El Obeid, but the column was surrounded and utterly destroyed in the desert through the treachery of native

guides, about November 3-4. A few of the survivors were taken by the Mahdi to Khartoum, but Colonel Hicks perished on the field.

Hicks-Beach, Right Hon. Sir Michael, b. 1837, entered Parliament in 1864; in 1868 he was Under-Secretary to the Home Office, and Chief Secretary for Ireland 1874-8 and 1886-7; in 1878-80 he was Colonial Secretary and Leader of the Commons for a few months in 1886, but resigned owing to ill-health. From 1888-92 he was President of the Board of Trade, and Chancellor of the Exchequer from 1895-1902, when he retired from official life. He took an active part against Mr. Chamberlain's Fiscal Reform policy, which was heavily defeated at the general election of 1906. In 1905 he retired from active political life and was made a Viscount.

Hidatza, a North American people, variously known as Minetarees, Gros Ventres, Paunch, and Fall Indians, who formerly roamed the steppe region between the Upper Missouri and the South Saskatchewan rivers, but who are at present confined to a reservation about Fort Berthold, North Dakota.

Hierapolis, a name given by the Greeks to many cities, of which the most important were:

1. Hierapolis in Syria Cyrrhestica, 16 miles from the junction of the Euphrates and the Sajur, and not far from Carchemish. Its first name was Bambyg, Mambug, or Mambe (in Greek *Bambyke*). We know nothing certain of the city's history until the Seleucid dynasty, when as Bambyece it grew populous and wealthy, deriving its appellation Hierapolis from the worship of the Syrian goddess Atargatis (Gr. "Derceto"). Crassus plundered it in 53 B.C., and under the emperors up to the time of Julian it was a strong and prosperous community. It then declined, and, though restored by Haroun-al-Raschid, it never recovered its former greatness. As Bayuk, Mambedj, or Kara Bambuche, the ruins still exist.

2. Hierapolis in Phrygia, at the confluence of the Lycus and the Meander, was celebrated in antiquity for its hot springs, used for dyeing as well as bathing and drinking. Epictetus was born here, and St. Paul (Coloss. iv. 13) founded a church. Kalessi Pambuk, or "Cotton Castle," is the Turkish designation of the locality, which preserves many perfect specimens of Greek architecture.

Hiero I. succeeded his brother Gelon as King of Syracuse in 478 B.C. He played an important part in the colonising of Sicily and Italy with Greeks, and by a great naval victory in 474 destroyed the maritime power of the Etruscans. In spite of his avarice and cruelty, he was a patron of the arts, and a personal friend of Alschylus, Simonides, and Pindar. He died in 467.

Hiero II., illegitimate son of Hierocles, a descendant of Gelon, on account of his military talents displayed against the Mamertines was elected King of Syracuse (270 B.C.). The Romans having espoused the cause of his enemies, he joined Hanno, the Carthaginian invader; but, having been defeated by Appius Claudius, came to terms on

condition that he should rule over the south-eastern part of the island. Henceforward he was a staunch ally of the Republic during both the first and second Punic Wars. He died in 216.

Hieroglyphics (Greek, "sacred sculptures"), the name given to the picture-writing in use amongst the ancient Egyptians. The objects depicted include human beings, birds, beasts, and fishes, the heavenly bodies, natural objects of all kinds, and articles of domestic use. There were various methods of hieroglyphic writing, but most frequently the signs were either cut out or carved in relief on stone or some other hard surface, or else drawn in outline on papyri with a reed pen. The hieroglyphs on monuments were often ornamented with colour. Those on papyri were written in black ink, a red mineral ink being employed for the rubrics and initial words. They were arranged either in horizontal or perpendicular rows, between which there were lines of black ink. The hieroglyphs were of two kinds—*ideographs*, which denoted the objects they portrayed or abstract notions which they would readily suggest, and *phonetics*, representing certain sounds. The phonetics were either alphabetic, ending in a vowel, or syllabic, ending in a consonant. A large collection of alphabetic signs is furnished by the earliest inscriptions which have been discovered, dating from 3800 B.C. An ideograph called a *determinative* is attached to the end of each word, generalising the conception, which is more precisely represented in the preceding phonetics. The language in which the hieroglyphs are written survived, with considerable modifications, in the form of Coptic, which was still spoken in Egypt in the 18th century. It belongs to the Hamitic group, but a Semitic element appears to have been introduced about 1400 B.C. The ancient Egyptian literature is treated under the heading HERMETIC BOOKS (q.v.).

The secret of hieroglyphic writing was jealously guarded by the priests, and the knowledge of Herodotus and other early writers concerning Egyptian mysteries was confined to such facts as they chose to communicate. When Egypt became a part of the Macedonian Empire a summary of the historic events recorded in the inscriptions and MSS. was drawn up in writing, and during the reign of Augustus the Romans seem to have been furnished with the means of deciphering them for themselves, but the Egyptian monuments did not excite their curiosity to any great extent. The *Stromata* of Clemens Alexandrinus (211 A.D.) is the earliest work which gives any precise information as to the nature of hieroglyphic writing. He was followed by Porphyry in 304 A.D., but from the 6th to the 17th century the study of hieroglyphics fell completely into neglect. It was revived in 1650 by Athanasius Kircher; but, as the symbols were supposed to be exclusively ideographic, no progress was made until 1787, when Zoega discovered that some of them had a phonetic value. The discovery of the Rosetta Stone (1799), with a trilingual inscription in hieroglyphics, in Semitic writing (the cursive or popular form of expressing

the hieroglyphs), and in Greek, all recording the same fact, enabled scholars to pursue their investigations on more systematic lines. The phonetic theory was carried further by Young in 1818, and the subsequent researches of Champollion, Lepsius, Bunsen, Brugsch, and other students have resulted in the detailed knowledge of the subject which exists at the present time.

It is the opinion of some scholars that the Phoenician alphabet, which was passed on by them to the Greeks and other western nations, was derived from the Egyptian hieroglyphs, but this theory has not by any means been firmly established.

The Aztec mode of picture-writing differed from the Egyptian in being mainly pictorial, but a phonetic system had been to some extent developed before the Spanish conquest. The inhabitants of Central America also had a symbolic method of writing peculiar to themselves.

Hierro or **FERRO**, one of the Canary Islands. Longitude is reckoned from it by some geographers. The chief town is Valverde.

Higgins, JOHN, a divine who flourished in the latter half of the 16th century at Winsham in Somersetshire. He produced an edition of Terence, a treatise on *Christ's Descent into Hell*, and a reprint, with additions of his own, of Sackville's *Mirror for Magistrates*. He died in 1603.

Higgins, MATTHEW JAMES, who wrote under the name of "Jacob Omnim," was born at Benown Castle, County Meath, in 1810, and educated at Eton and Oxford. He spent his early manhood in travel, visiting the West Indies and most parts of Europe, and it was not until 1847 that he came into prominence in connection with the relief of the Irish famine in 1847, when he tried unsuccessfully to enter Parliament. From 1848 to 1854 he took an active interest in the *Morning Chronicle*, then the organ of the Peelites. He next associated himself with the *Times*, and his letters signed "J.O." "Paterfamilias," "A Belgravian Mother," etc. etc., appeared in that paper until 1863. He sent contributions later to the *Pall Mall Gazette*, though many of his longer articles appeared in the reviews and magazines, especially the *Cornhill*, whilst under the direction of his intimate friend Thackeray. Mr. Higgins, who was a Catholic, married a daughter of Sir A. J. Tichborne, and died in 1868.

Higginson, THOMAS WENTWORTH, born at Cambridge, Massachusetts, U.S.A., in 1823, and educated for the ministry at Harvard, abandoned the pulpit for politics in 1858. An ardent abolitionist, he became during the War of Secession colonel of the first coloured regiment raised by the Federals. He was severely wounded in 1863, and left the service to devote himself to literature, acting from 1881 to 1884 on the State Board of Education. Many of his books are in support of the rights of women, but his larger and smaller *History of the United States*, his *Translation of Epictetus*, and his *Army Life in a Black Regiment*, possess wide interest.

Highgate, a parish and suburb in the north of London and the county of Middlesex, is said to derive its name from a toll-bar erected where the great north road passed through the Bishop of London's park. The village stands on a hill 426 feet high, at the base of which may be seen the Whittington Stone, renewed in 1821, and the almshouses founded by the famous Lord Mayor. Many fine mansions were built here in the 16th and 17th centuries, few now remaining. Lauderdale House still exists in the park which Sir Sydney Waterlow has dedicated to public use. The church of St. Michael, rebuilt in 1832, contains a monument to Coleridge, who lived here for many years. The grammar school, founded by Chief Justice Cholmeley in Queen Elizabeth's reign, was reconstructed in 1868. Lower down the hill is St. Joseph's Retreat, a spacious Roman Catholic institution of recent date. The North London Cemetery close by contains the graves of many eminent personages. The Horns tavern used in former days to be the resort of merry-makers, who went through the mock solemnity of being sworn on the horns. Among other celebrities connected with the place are Lord Lyndhurst, Michael Faraday, and Baroness Burdett-Coutts.

Highlands, THE, a term used somewhat vaguely to designate the mountainous portion of Scotland lying N. of an imaginary line beginning at Nairn on the Moray Firth, running S.E. to the Dee at Dinnet, thence S. to the West Water in Forfarshire, and ending at Ardmore on the Clyde, the whole of Argyleshire and the islands, except Arran, being included in the division N. of the line. The Lowlands, of course, are the districts south of this ill-defined boundary. The use of the Gaelic language and the ethnological characteristics of the native population roughly serve to mark off one division from the other. A very distinct geographical feature, viz. the chain of lakes connected by the Caledonian Canal, separates the Northern from the Southern Highlands, whilst a less clear boundary limits the area popularly known as the Western Highlands.

High Ordnance. [ORDNANCE.]

Highwaymen, robbers who attack and pillage persons passing along the highway. The most renowned English highwaymen were Claude Duval (1643-70), Dick Turpin (1705-39), and Swift Nick Nevison, hanged at York in 1684. Out of a story concerning Nevison grew the legend of Dick Turpin's ride to York.

Hilary, ST., "of Arles," was born about 401 on the borders of Lorraine. He succeeded his kinsman St. Honoratus as Bishop of Arles and Metropolitan of Vienne and Narbonne. In this latter capacity he deposed Chelidonus, Bishop of Besançon, against the orders of Pope Leo I., who deprived him of his functions, a sentence confirmed by the memorable edict of Valentinian III. He continued, however, to exercise the duties of his see until his death in 442. Besides his reputation for austere piety and devotion to the Gallican Church, he enjoyed some fame as an author, his extant *Life of*

St. Honoratus and *Metrical Version of the First Chapters of Genesis* showing considerable literary power. In the Roman Calendar his day is kept on May 5. Some writers consider him to have been the author of the so-called Athanasian Creed.

Hilary, ST., "of Poitiers," known as "the Athanasius of the West," and "Malleus Arianorum," was born at Poitiers about 300. A pagan and a married man, he embraced Christianity somewhat late in life, and was made bishop of his native town in 350, continuing to live with his wife. He stood forth as one of the staunchest opponents of Arian doctrines, then supported by the Emperor Constantius, and, having addressed an epistle to that sovereign, was by him banished into Phrygia. He returned in 360 after composing in exile his famous treatises, *De Synodis*, *De Fide Orientalium*, and *De Trinitate*, and after personally visiting the Emperor at Constantinople. His later years were devoted to the task of commenting on the Psalms, the Gospel of St. Matthew, and the Book of Job. He died on January 13, A.D. 368, and his name is perpetuated in *Hilary Term*, though that begins on January 11, three days before the date with which his name is associated in the Roman Calendar. The *Te Deum Laudamus* is occasionally attributed to him.

Hilda, ST., or HILD, daughter of Herreric, nephew of Edwin, King of Northumbria, was born about 614, and was baptised at the age of 14 by Paulinus. During the pagan period that followed, Edwin and she were sent to Paris, but being recalled by Bishop Aidan of Iona she became a nun, and was appointed in 649 Abbess of Hartlepool (Heortea), and ten years later founded the famous convent at Whitby for monks as well as nuns, ruling this mixed community with rare ability and vigour. She died in 680, leaving behind her a saintly reputation, which still clings to her memory.

Hildesheim, an ancient town on the river Innerste in Hanover, North Germany, 18 miles S.E. of the capital of the province. It is a quaint old place, with narrow streets overhanging wooden houses of the mediæval type, and many fine churches, such as the Catholic cathedral (founded in 818, and actually built two hundred years later), St. Godehard's, a Romanesque structure of about the same date, St. Michael's, and St. Magdalene's, containing relics of Bishop Bernward, with several others of the Protestant cult. There are also a town hall of the 15th century, the Georgstift, a retreat for the daughters of state officials, and a number of other public institutions. Hildesheim does not come into historical prominence until 822, when it became the seat of a bishopric, which maintained independence for nearly 1,000 years. The industries are linen-weaving, lacquer-making, distilling, carriage-building, etc. In 1868 a remarkable treasure of silver-plate of the Augustan period, supposed to have belonged to Drusus, was dug up on a neighbouring hillside.

Hill, AARON, was born in London in 1685. At the age of fifteen joined his kinsman, Lord Paget,

then ambassador at Constantinople, under whose auspices he saw all the eastern shores of the Mediterranean. Coming home in 1709 he wrote a *History of the Ottoman Empire* and a poem entitled *Camillus*, in praise of Lord Peterborough. He soon afterwards became manager of Drury Lane, moving afterwards to the Haymarket opera-house. Before he lost these posts through his own folly, he wrote 17 dramas, of which *Elyrid or the Fair Inconstant*, *Zara*, and *Merope*, were the most successful. He also composed the libretto of *Rinaldo* for Handel. Pope gave him a place in the *Dunciad*, and was sharply attacked in return. Dying about 1750, he found a grave in Westminster Abbey.

Hill, REV. ROWLAND, was born in 1744, being the third son of Sir Rowland Hill, Bart., the head of an old Shropshire family. As an undergraduate he began to roam about the country and preach to the poor, associating himself with Berridge and Whitfield. In 1774 he was ordained, and held for a time the cure of Kingston, Somerset, but the routine of the Establishment was irksome to him, and, though never dissociating himself from the Church, he struck out an independent line, came to London, and in 1784 opened an unlicensed place of worship—the Surrey Chapel. Here for nearly fifty years he worked on in his own eccentric way. He was, moreover, an ardent supporter of the Sunday School movement, of the London Missionary Society, the Bible Society, and the Tract Society, and he wrote a volume of *Hymns* that still has a hold on popular affection, besides several controversial books of less merit. So great faith had he in the newly-invented practice of vaccination that he operated on no fewer than 40,000 persons. His death occurred in 1833.

Hill, SIR ROWLAND, K.C.B., born at Kidderminster in 1795, and in 1825 settled at Bruce Castle, Tottenham, as a schoolmaster, but soon abandoned that career on the score of ill-health. For a few years he was secretary to an association for colonising South Australia. Accidentally his attention was drawn to postal organisation, and in 1837 he published a pamphlet entitled *Post Office Reform*, in which he advocated penny postage and the use of stamps. His propositions were scouted by the officials, as might have been expected, but fortunately they took with the public; agitation ensued, Parliament was appealed to, and in 1840 this great measure was carried. Hill was appointed to a place in the Treasury, in order to advise on the new organisation, but the Peelite Ministry cast him adrift two years later, a step that aroused general indignation and brought Hill a handsome public testimonial of £13,000. He became for a brief period chairman of the London and Brighton Railway, introducing the system of cheap excursions. In 1846 the Liberal Government gave him the secretaryship to the Postmaster-General, and he ultimately became Chief Secretary. He retired in 1864, receiving a pension of £2,000 a year and a grant of £20,000. He was a namesake but not a kinsman of Rowland Hill the preacher.

Hillel, HAZZAKEN, or "the Elder," a Jewish

rabbi of Davidic stock, was born at Babylon, probably about 75 B.C., though some traditions fix the date as 112. His zeal for the study of the law was so strong that he made his way to Jerusalem, and, whilst working as a day-labourer, contrived to attend the Beth-Midrash, and ultimately rose to be president of the Sanhedrim with the title of Nasi or prince. To him are ascribed the seven Middoth, or rules of interpretation, and the Prosbol, in both of which he endeavoured to adapt the stiff precepts of Judaism to the needs of progressive society. He is identified by some with the Pollio of Josephus, and is said to have been the grandfather of Gamaliel I. Our only authority, however, for the meagre outline of his career is the Talmud. He died about 10 A.D.

Hiller, FERDINAND VON, was born at Frankfort of Jewish parents in 1811, and, showing an early aptitude for music, was put under the tuition of Hummel at Weimar. After spending seven or eight years in Paris, he went to Italy in 1836, and composed his first great work, an oratorio entitled *The Destruction of Jerusalem*. On his return to Germany in 1840 he produced two operas, *A Christmas Night's Dream* and *Conradin*. Among his many works, all examples of the classical style, may be mentioned *Saul*, an oratorio, the *Spring Symphony in E*, *Nala and Damajanti*, a cantata composed for the Birmingham Festival of 1871, and a volume of songs. He wrote well and copiously on musical subjects, his *Reminiscences and Letters of Mendelssohn*, *Records of Modern Musical Life*, *Goethe as a Musician*, and *An Artist's Life* being admirable contributions to this branch of literature. He died in 1885.

Hill Forts, in a specific sense, are the strongholds of the primitive inhabitants of various European countries, many of which are of prehistoric origin. They are usually more or less circular, the precise form of the fort or forts being determined in each case by the nature of the ground. Sometimes, when surrounding hills afforded sufficient protection, the fort itself was not placed on a summit but in a lower position, affording ready access to the neighbouring meadows and pastures. Often a line of forts was made, enclosing the whole of the upper part of a hill, which thus became a little citadel or town; in fact the name of *oppida* was given by the Romans to the fortresses which they found in Gaul. In some countries, as for example England, earthworks are commoner than stoneworks; in Wales, on the other hand, stone is the usual material. The Gallic forts were built of dry-stone masonry, strengthened by the insertion of thick logs of wood, and the same method of construction was employed at Buryhead in the north of Scotland—a country in which hill forts or "dunes" (q.v.) are exceedingly common. The largest fort in England is that at Cissbury in Sussex, which extends over 60 acres. In Ireland there are large stone forts on the Isles of Arran and elsewhere. Of the vitrefaction observable on the surface of the walls in France, Scotland, Ireland, Hungary, and elsewhere no satisfactory explanation has as yet been given.

Himālāya. (Sans. "snow-abode" or "snow-mountain"), the name popularly given in various parts of India to the peaks visible upon the northern horizon, and adopted by geographers to designate the entire system of mountains that in length stretches from the Brahmaputra to the Indus (1,500 miles), and in breadth embraces the watersheds of those rivers and of their chief tributaries, extending over 150 miles. The name is only a convenient appellation for that part of the fringe of the great Tibetan tableland which abuts upon Hindostan. That plateau has an average elevation of 15,000 feet, whilst the plains of Northern India seldom attain 1,000 feet above sea-level. The course of the rivers plainly shows that the vast chain of the Himalayas is but a corrugation, so to speak, upon the still vaster slope which trends from the sea to the Central Asiatic plateau. The ridge has power to check the southward flow of the Indus and Brahmaputra, but not to turn them back, and here and there streams, as the Sutlej, actually break through the barrier, though the passes average a height of 18,000 to 20,000 feet, whilst the dominant peaks such as Mount Everest (Nepal), the highest point yet measured on the earth's surface, Kinchinjunga (Sikkim), and Dhawalagiri (Nepal), attain 29,002, 28,156, and 26,826 feet respectively, and many summits exceed 25,000 feet. As yet geological observations have been too incomplete to throw much light on the structure of these mountains. The outer ranges known as the Siwaliks or sub-Himalayas are of recent formation, the fossils pointing to the Miocene or Pliocene period, but these strata are close to nummulitic beds of distinctly marine origin, and on reaching the flanks of the higher peaks fossils disappear and the rocks assume a metamorphic character—greenstones, slates, schists, and conglomerates being intermingled freely. Granitic intrusions occur here and there, and permeate as veins the highly crystalline gneiss or schistose rocks of which the summits are built up. Geologists are of opinion that the existence of the range is not due to any violent upheaval, but that the elevation is recent and attributable to the cooling and contraction of the earth's crust. Glaciers of vast area are abundant, but, as they do not descend to so low a level as in Europe, they were long supposed to be non-existent. The rainfall, especially on the outer ranges and in the eastern quarter, is very heavy between May and October, but diminishes on the higher levels and sinks to an inappreciable amount in Tibet.

Himyarites, a historic people of South Arabia, whose domain included the present Yemen (Arabia Felix) and the Hadramaut coastlands eastwards to Oman. The name in its Greek form *Homeritæ* occurs first in Pliny and Ptolemy, both of whom describe them as closely related to the Sabæans, who are placed in the same region. Later the latter term fell into disuse, while Himyar, that is *Aḥmar* ("red"), was adopted by the early Christian and Arab writers, as the general designation of all the peoples of South Arabia, who in pre-Mohammedan times spoke a Semitic language distinct from and

of a more archaic type than the Arabic. The Himyarites and Sabæans were, in fact, mere branches of the same Semitic race, which probably had its origin in the south-west Arabian uplands, and spread thence, long before the dawn of history, across the Red Sea, possibly so named from them, into Abyssinia. At a still more remote epoch they migrated northwards through Arabia into Phoenicia, Canaan, Syria, and Mesopotamia, which regions constitute the original domain of the Semitic family. That the Himyarites were the original stock and Arabia Felix the cradle of the Semites, seems probable from the fact that their language, still preserved as the liturgical language of the Abyssinian Christians [GEEZ], is by far the most primitive of all the Semitic tongues. [EHKILE.] The genealogies of the Himyarites given by Ibn Khaldun in his *History of the Berbers* are fanciful, but they serve to show how far the Arabs proper regarded the primitive inhabitants of Yemen as their kinsmen. They are traced in these tables, through Himyar, grandson of Kahtan [YECTAN] to the Heber of Genesis x. 24, and are described as the oldest and purest branch of the race, hence called *Arab el-Aribah*, "Arabs of the Arabs." With the spread of Islam they adopted the language of the Koran—that is, of the Koreish Arabs; and their descendants, the present inhabitants of Yemen, are no longer pure Arabs, but much mixed with black blood through the female slaves imported from Africa during the Mohammedan period. (J. H. Mordtmann and D. H. Müller, *Sabäische Denkmäler*, Vienna, 1881; *Lay of the Himyarites*, edited by W. F. Prideaux, 1880.)

Himyaritic Languages. [HIMYARITES.]

Hincmar, ARCHBISHOP, born of noble Frankish blood about 806, was educated for the priesthood at St. Denis, of which foundation he became canon, acquiring also considerable influence at the courts of Louis the Pious and Charles the Bald, until in 845 he was elevated to the see of Rheims on the deposition of Ebo. The Pope confirmed his election, but when he proceeded to depose some of the clergy ordained by his rival, especially the Bishop of Soissons, Pope Nicholas I. interfered, and the Isidorian decretals were issued, materially advancing the authority of Rome; but the archbishop subsequently, in defiance of Adrian II. and the Emperor, crowned Charles as King of Lorraine, and severely punished the rebellion of his nephew, the Bishop of Laon. Many years of his life, which ended at Epernay in 882, were spent in a controversy with Gottschalk (q.v.) on predestination, and he wrote on this subject several treatises with the aid of John Scotus Erigena.

Hind, the female of the Stag (q.v.), especially after its second year. The term is sometimes used for the females of Asiatic deer, and even for female Antelopes.

Hind, JOHN RUSSELL, F.R.S., was born at Nottingham in 1823, and at the age of seventeen, abandoning civil engineering, for which he was destined, took a post as assistant in the Greenwich Observatory, and in 1844 was employed in the

important duty of measuring the astronomical difference of longitude between Greenwich and Valentia, Ireland. Professor Airy induced him next year to become superintendent of Mr. Bishop's Observatory in the Regent's Park. Among his works, most of them written in a popular style, are *The Solar System*, *An Astronomical Vocabulary*, *The Illustrated London Astronomy*, and *A Descriptive Treatise on Comets*. He, moreover, edited the *Nautical Almanac*. He died in 1895.

Hindu, properly the collective name of the Indian branch of the Aryan peoples, who entered the peninsula from the north-west and consequently formed their first settlements on the banks of the Indus (Sindhu, Hindhu); but the term is not of native origin, and only came into general use during the Mohammedan epoch through Persian influence, as shown by the change of *S* to *H*, a phonetic process characteristic not of the Indic, but of the Iranic, as also of the Hellenic branch of the Aryan languages. Even now the term *Hindu*, as well as *Hindustan* ("Hindu Land"), is used chiefly by the Mohammedans, and by them restricted to the region roughly corresponding to the British administrative division known as the "North-West Provinces"; but it is now applied by European writers in a general way to all the inhabitants of India, and in a religious sense to those professing the Brahmanic as opposed to the Buddhistic religion.

Hindu Kush is the name given to a range, or rather group, of lofty mountains towards which the Himalayan and Thian Shan systems converge, it being more closely connected with the latter than the former. Striking off from the S.W. angle of the Pamir plateau, this huge watershed extends W. for 365 miles to the Bamian Valley in Afghanistan, where the triple peak of Koh-i-Baba (16,500 feet) ends its course. From N. to S. the subsidiary ridges spread, perhaps over 200 miles. Towards the E. the passes are easy, but in the central and W. portion they average from 12,000 to 15,000 feet, and some of the peaks—e.g. Hindu Koh and Tirich Mir—are estimated at more than 20,000 feet. Geographers divide this mass into the Chitral, the Kafiristan, and the Panjhir sections, according to the valley basins into which the slopes drain; but this arrangement is somewhat arbitrary. Roughly speaking, the whole range separates the basin of the Kabul river from that of the Oxus, and Afghanistan proper from Turkestan. Geologically the Hindu Kush seems to consist mainly of mica slate, gneiss, and schist, with veins and cappings of granite on the higher levels. Limestone is not infrequently met with, and is generally burrowed by extensive caves. Minerals of all kinds are abundant, especially iron, but no fuel is known to exist.

Hindustani, a Neo-Sanskritic language which is based on the Hindi vernacular of the Doab (the region between the Ganges and Jumna rivers). Here it took its present form in the 16th century in the camps of the Moghul conquerors, and hence its native name *Urdū Zabān* ("camp language"). In its structure it is essentially Indic, though the synthetic Sanskrit forms are mostly replaced by

analytic constructions, and in this respect it is the most advanced of all Sanskritic tongues. In its vocabulary it is, like English, a composite language, the three chief elements being Sanskrit, Persian, and Arabic, the two latter increasing or diminishing according as it is spoken or written by Mohammedans or Hindus. It is also written in three different characters: Devanagari by the Hindus, the Persian form of the Arabic, with a few additional letters by the Mohammedans, and the Roman by the missionaries and other Europeans. The literature is copious, comprising histories, annals, tales, educational works, and much poetry, mostly translations, or based on Persian originals. Hindustani has always been more of a *lingua franca* than the language of any particular district, and as such is now current in almost every part of the peninsula, being spoken altogether by over 100,000,000, but by few exclusively. There are two distinct forms, the Northern, and the Southern, or Dakkhi, spoken in the Deccan, which presents many peculiarities of structure due to the influence of the surrounding Dravidian languages.

Hinny, the offspring of a stallion and a she-ass. It is smaller, but more docile than the mule (q.v.). Some early Continental naturalists thought these animals were the hybrids between equine and bovine species. Some curious information on the subject will be found in Blumenbach's *Treatises* (edited by Bendyshe).

Hinton, JAMES, M.R.C.S., was born at Reading in 1822, being the son of a clergyman. He started on a business career at the age of sixteen, but soon abandoned it for surgery, and in 1847 took his diploma. After spending some years at sea and in Jamaica, he settled down in London as a specialist, devoting his exclusive attention to diseases of the ear. He speedily rose to the top of the profession in this department. His real bent, however, was towards metaphysics and psychology, upon which he brought to bear much originality and earnestness. Finally he developed a kind of scientific mysticism which can be traced in his various works: *Man and His Dwelling-Place*, *Life in Nature*, *Thoughts on Health*, and *The Mystery of Pain*. He died in 1875. Miss Ellice Hopkins has written a *Life*.

Hip. The hip joint is a typical ball-and-socket joint. The socket of the joint is formed by a depression which exists on each side of the outer aspect of the pelvis, and is called the *acetabulum*: in this depression the rounded head of the femur or thigh-bone rests, being retained in its place by a series of ligaments, one of which, the capsular ligament, is attached, on the one hand, around the edge of the acetabulum, and, on the other, to the neck of the femur just beyond its head, enveloping the latter and limiting the extent of the joint cavity. The movements at the hip joint are very free. The joint is deeply situated, and thus escapes many forms of disease which affect more superficially situated joints. The principal affections to which it is subject are as follows:—

Dislocation of the hip may occur in four different

directions. The most common form is dislocation of the head of the femur upwards and backwards. The symptoms are distortion, inability to move the joint, the limb is shortened, and the head of the femur can generally be made out in its displaced position. Treatment consists in reducing the dislocation and keeping the patient in the recumbent position until such time has elapsed as will allow of the repair of the injured parts.

Diseases of the Hip. The hip is not uncommonly affected by the disease known as *osteo-arthritis*. The joint is, as might be expected, often involved in fractures of the neck of the femur. The most important diseased condition affecting the hip, however—"hip disease" *par excellence*—is what is known as strumous disease of the hip joint. This malady particularly affects children and young adults. The chief symptoms are pain (which, curiously enough, is sometimes felt in the knee joint, although it is the hip and not the knee which is at fault), lameness, a distorted position of the leg with respect to the body, and limitation of the power of moving the joint, the muscles of the affected limb waste, and when the disease becomes established collections of matter occur in the neighbourhood of the joint. Early treatment of the disease is most imperatively called for, as, if abscesses are allowed to form, pent-up matter burrows deeply into the tissues, causing much damage and disorganisation before it makes its way to the surface. In neglected cases of hip disease amyloid degeneration of the liver, spleen, and kidneys is apt to supervene; tubercular meningitis, and tubercular disease affecting other parts of the body may occur as complications. Treatment consists in keeping the patient absolutely at rest in the recumbent posture, splints are applied to the legs, and an attempt is made to gradually correct the deformed position of the affected limb by the application of what is called *extension*. A weight is adjusted by means of a pulley so as to continually exert tension in the appropriate direction upon the limb which is involved, and this process of extension requires, as a rule, to be kept up for some months. If collections of matter form, the pus must be evacuated under suitable antiseptic precautions, and in some instances of advanced hip disease it is deemed necessary either to remove the diseased tissues (excision of the hip joint) or to amputate the limb.

Hipparchus. 1. A native of Nicæa in Bithynia, flourished from 160 to 125 B.C. He was the first to apply strict mathematical methods to astronomy, and he probably made the catalogue of 1,080 stars preserved by Ptolemy. Only one of his works is extant, viz. *A Commentary on the Phenomena of Aratus and Eudoxus*.

2. Son of Pisistratus, Tyrant of Athens, who inherited supreme power jointly with his brother Hippias in 527 B.C. Though he seems to have been an enlightened ruler, and a patron of art and letters, he was assassinated in 514 by Harmodius and Aristogeiton (q.v.). His brother retained authority till 511, but displayed in these latter years a cruel and suspicious temper. On being expelled, he betook himself to the court of Darius, and is said to have

acted as guide to the Persians in their invasion of Greece, perishing at the battle of Marathon in 490.

Hippocampus (SEA HORSE), a genus of Lophobranch fishes of the family Syngnathidae, with about twenty species widely distributed, especially in tropical and subtropical seas. They are of small size, and the front part of the body presents a strange resemblance to that of a horse, and ends in front in a snout, and behind in a prehensile tail, which in the males has a sac at its base, in which they carry the eggs. Pectoral fins and a soft dorsal are present. *H. antiquorum*, common in the Mediterranean, is sometimes taken on our coasts. The three species of the allied genus *Phyllopteryx*, from Australia, are about a foot long. There is no pouch, but the eggs are embedded in the soft membrane near the tail. The body is covered with filaments so as to resemble floating weed. [FISHES, vol. iv. p. 305.]

Hippocrates, "the Father of Medicine," was born about 460 B.C. A descendant of *Esculapius*, he belonged to the Asclepiades, and his father was a physician. Little is known of his life, which was spent partly in travel, partly in practice at Athens, where he won a high reputation. He died at Larissa, at the age of 85, according to some, others adding five-and-twenty years to this figure. No fewer than eighty-seven treatises are ascribed to him, but of these not more than twelve or thirteen are accepted as genuine. These latter deal with a variety of topics—*e.g.* prognostics, epidemics, regimen, public health and climate, fractures, injuries to the joints and head, etc. The most widely known of his works is *The Aphorisms*, but it is of doubtful authenticity and inferior to much of his work. He appears to have had an inkling of the method of diagnosis by auscultation, as is testified by the phrase "Hippocratic susscussion" in use for many centuries. The *facies Hippocratica* is the expression worn by the features of a person immediately before death.

Hippodamia was, according to Greek legend, the daughter of Cenomans, King of Pisa in Elis, by Asterope, one of the Pleiades. In obedience to an oracle her father promised her hand to anyone who could defeat him in a chariot race, death being the condition of failure. Several aspirants had met their fate when Pelops, a Lydian prince, appeared on the scene. He bribed Myrtilus, the king's charioteer, who caused his master to ride in a broken chariot. A disaster ensued which cost Cenomans his life and made Hippodamia the bride of Pelops, to whom she bore Atreus and Thyestes.

Hippolytus. 1. The legendary son of Theseus and Hippolyte, who had the misfortune to win involuntarily the love of Phœdra, his stepmother. As the youth's modesty was proof against her advances, she denounced him to her husband for the crime which he had refused to commit. Theseus drove his son forth, calling upon him the wrath of Neptune, who sent his sea-calves to frighten by their bellowing the horses of Hippolytus as he drove along the shore. He was thrown from his chariot and torn to pieces among the rocks, and

his story provided material for the *Hippolytus* of Euripides and the *Phèdre* of Racine.

2. A Greek Christian writer of the 3rd century, who appears to have lived and taught in Rome. He took part against Callistus in the controversies of the day, and under Alexander Severus is said to have been banished to Sardinia, dying there about 240. His most valuable work is entitled *Omnium Hæresium Refutatio*, and contains most interesting information as to the ante-Nicene controversies.

Hippopotamus, a genus of aquatic Artiodactyle Ungulates, constituting a family (Hippopotamidae), ranging back to Miocene times, and having a representative (*H. major*) in the English Pliocene of even larger size than the common form. There



HIPPOPOTAMUS.

are but two living species—*H. amphibius*, the Common Hippopotamus or River-horse, till within recent times distributed over the greater part of Africa, where its range is becoming restricted, and *H. liberiensis*, the much smaller Liberian hippopotamus, confined to western tropical Africa. The latter is sometimes made a distinct genus (*Charopis*), from the fact that it has only two incisors in the lower jaw, the dental formula being $1\frac{1}{2} \text{ c } 1\frac{1}{2} \text{ m } 4$ or $\frac{1}{2}$. The family occupies a position between the swine and the deer, but is more closely related to the former than to the latter group. The lower canines are tusk-like, the stomach imperfectly divided, the body massive, and the limbs four-toed. There are two teats, inguinal in position. The Common Hippopotamus, supposed to be the "behemoth" of Job, is about 14 feet long and about 5 feet high at the shoulder. The head is thick and square, the muzzle large and tumid, and the ears and eyes small. The animal can close both nostrils and ears when under water, and the eyes are so high up that on rising to the surface it can command a wide

field of vision without exposing much of the head or body. The skin is very thick, hairless, and full of pores that exude a fatty secretion, and the tail is short. The general colour is a dark brown, but partial and entire albinism is recorded. These animals are generally found in herds in rivers and lagoons, sometimes in brackish estuaries. They feed during the day on water-plants, and at night come on shore, where they commit great havoc among the crops, especially of green corn. Although so clumsy-looking, they swim with ease, and move rapidly through the thickets when on shore. They appear to be inoffensive when left alone, but when roused or wounded they are dangerous foes. Instances are recorded of their biting a man literally in two, and Sir Samuel Baker tells how one charged a steamboat and pierced two of her iron plates with its tusks, "as if a sharp pick had been driven through them." The hippopotamus is hunted by the natives for its flesh (about the quality of which white men do not agree), its hide, and its ivory, which is specially valued by dentists. European hunters of "large game" have done their part in thinning the numbers and restricting the range of these animals, which render no little service by clearing the vegetation from the beds of streams and lakes, and so preventing the increase of marsh land in the Dark Continent.

Hippuric Acid is a compound, of composition $C_6H_5NO_3$, which occurs largely in the urine of herbivorous animals. It may be obtained from this source by adding lime, filtering, and, after concentrating the liquor obtained, adding hydrochloric acid, when hippuric acid is precipitated as a crystalline powder, soluble in hot water or alcohol. It is also found in human urine if certain aromatic substances be taken into the body. It may be prepared by numerous synthetic reactions, which show its constitution to be that of *benzoyl-glycine*—i.e. glycine (q.v.), one hydrogen of which is replaced by the radical benzoyl. [BENZENE.]

Hippuritidae, an extinct family of Lamellibranchiata (q.v.), which flourished during the Cretaceous period. They were allied to the Chamas or Clams; they had a high, almost tubular, right valve, which was attached to rocks, the sea floor, or other shells; they lived in colonies. The left or upper valve is a thin flat plate. Though very abundant in the chalk of France and the south of Europe, the type genus *Hippurites* has not yet been found in England.

Hiring, legally known as "bailment for hire," and in Scotland as "location," is in the nature of a contract to be performed for reward or compensation. There are four sorts of hiring, viz.:—1. The hiring of anything for use. 2. The hiring of work and labour. 3. The hiring of care and services to be performed or bestowed on a certain thing delivered. 4. The hiring of the carriage of goods from one place to another. The three last are subdivisions of the general head of hire of labour and services. The rights, duties, and obligations of the parties resulting from such a contract are too elaborate to be given here.

Hirudinea. [LEECH.]

Hissar. 1. A division, district, and town of the Punjab, in British India. The division includes the three districts of Hissar, Rohtak, and Sirsa, having an area of 8,355 square miles. It lies between Sirhind and Rajpootana, and, fringing the Bikaner deserts, is liable to droughts and famines. The district of Hissar, forming the central portion of the division, extends over 3,539 square miles. It exports large quantities of oil-seeds, grain, copper and brass ware, hides, saltpetre, and some cotton. The climate is very dry, and the soil, when irrigated, highly productive. The white cattle are famous throughout India. The Ghaggar is the only river, and the water-supply is derived chiefly from the West Jumna Canal. Hindus of the Bhatti tribe make up three-fourths of the population. Bhawani is the commercial centre, and is three times as large as Hissar, the seat of administration, or Hansi, the only other municipality.

2. A state in Central Asia, lying north of the river Oxus, and opposite to Balkh, in Afghanistan, between the desert to the west and the provinces of Karategin and Darwaz to the east. It is nominally, since 1870, under the government of the Khan of Bokhara, but the Russians explored its almost unknown recesses in 1875, and have since acquired an influence. One of the three roads, all difficult, by which it can be reached from Bokhara is through the renowned defile of Kohlugh, said to have been once closed by a gate of iron. The Surkhab, Kafirnihan, Sarkhan, and Shirabad-Daria, tributaries of the Oxus, traverse the country, which, though extremely mountainous, is fertile in the valleys. Derbend, Shirabad, Baisun, and Hissar, the strategical capital, are the chief towns; and Kulab, in a district of its own, lies beyond the Sarkhan, which is spanned by the ancient stone bridge of Pul-i-sanghin. The inhabitants are mainly Uzbeks or Tajiks, under seven semi-dependent begs. Hissar, meaning "fort," is the name of many other Asiatic towns.

Histology is the science which treats of the minute anatomy and microscopic appearances of the tissues of animal bodies. The whole of the animal body is made up of cells, or the derivatives of cells, and great advances have been made within recent years in the study of the various modifications which cells undergo, and accurate knowledge of the way in which these cells are built up to form the several organs of the body has been obtained. [BLOOD, EPITHELIUM, CONNECTIVE TISSUES, MUSCLE, GLANDS, NERVE, ETC.]

Histology, VEGETABLE, is the study of the tissues of which all multicellular plants are composed. A *tissue* is an aggregate of cells or vessels obeying a common law of growth and, as a consequence, resembling one another. A *true tissue* is the result of cell-division; a *false tissue*, of the approximation of cells of independent origin. Tissues may be *merismatic* or *meristem*, when their cells retain their protoplasm and the consequent power of cell-division; or *permanent*, when they have lost this. Again, they may be *parenchymatous*, when their cells are not much elongated, when there are generally marked intercellular spaces; or they may be *prosenchymatous*, with

elongated elements. Thirdly, tissues may have the walls of their constituent cells *unthickened* or *thickened*, and in the latter case the term *sclerenchyma* is applied when the walls are hardened by a ligneous deposit, and *collenchyma* when the corners of cells are thickened mucilaginous. Of these *kinds of tissue*, the embryo and the growing points of stems or roots exhibit a meristem known as *primary*, or in the latter case as *apical*, from which at an early stage three or four primitive *tissue-systems*, the *dermatogen* or primitive epidermis, the *plerome*, or primitive vascular axis, the *periblem*, or primitive cortex, and in roots the *calyptrogen*, or primitive root-cap, are commonly differentiated. In roots and stems, zones of tissue remaining merismatic until a late period are known as *secondary meristem*. Of this the *cambium-ring* of the exogenous stem, the *pericambium* of roots, and the *phellogen*, or cork-cambium, are examples.

Tissues may also be grouped under six *systems*. (1) The *fundamental* or *ground-tissue*, from which all the others have been differentiated and which remains as a sort of connective tissue between them, is permanently represented by the inner or *primary cortex*, the *hypoderm*, often *collenchymatous*, immediately below the epidermis, and the *endodermis* or bundle-sheath. (2) The *epidermal*, or *limitary system* is usually a single layer of somewhat flattened, colourless cells, with hairs and, on those parts exposed to air, stomata (q.v.) and sometimes excreting a waxy bloom or a separable outer thickening or *outline*. (3) The *fascicular* or *fibro-vascular system* originates in isolated merismatic strands of the plerome which are then known as *procambium*, and from this isolated origin its members are termed *bundles*. It forms the veins of leaves and, in the higher plants, the bulk of the stem. Each bundle consists of two groups of elements, *xylem*, or wood, and *phloem*, or bast, either exclusively, as in the *closed bundles* of leaf-veins or of the stems of monocotyledons; or with a zone of cambium between them, as in the *open bundles* of the exogenous stem. Xylem consists of three or four kinds of elements, viz. *vessels*, or cell-fusions with thickened walls; *tracheids*, or elongated vessel-like but unfused cells; *woody fibre*; and *wood-parenchyma*. Phloem consists of *sieve-tubes*, the protoplasm-containing vessels of the bast; *bast-fibres*, the long flexible elements that form the bulk of the whole phloem; and *bast-parenchyma*, including the elongated *cambiform-cells*. (4) The *medullary system* consists mainly of unthickened and often parenchymatous pith. (5) The *cortical system*, in addition to the *primary cortex*, originating directly from the periblem and often consisting of thin-walled parenchyma filled with starch, comprises the *phellogen*, or cork-cambium layer, the *periderm*, or *secondary cortex*, of muriform parenchyma with cuticularised walls filled with air, which is formed by the phellogen, and the *phelloidem*, or hypodermal chlorophyll-containing layer. (6) The *secretory system* comprises those more or less disconnected elements imbedded in tissues of other systems but devoted to special secretions, such as oil-cavities, resin-passages, and

lacticiferous tissue. Many of these tissues and tissue-systems are separately described.

Hittites, an extinct civilised people, who appear to have flourished about 1200 B.C., when their empire extended from the Upper Euphrates westwards to the Aegean Sea and southwards to Syria, where they were conterminous with the Aramean Semites. Their capital was at Kar-khemish, on the Euphrates, and other centres of their culture were Jerablús and Hama (Hamath), near the present Aleppo, in all of which places certain presumably Hittite stone inscriptions have been discovered in recent years. The attempts hitherto made to decipher these inscriptions have led to no certain results. The letters, which strongly resemble those found in 1879 by Professor Sayce on the so-called "False Ramesis" near Smyrna, seem to be partly ideographic, partly syllabic, or intermediate between hieroglyphics and phonetic writing. But their true character, as well as the language in which they are written, is still matter of conjecture. The term "Hittite," applied to this unknown people, is purely conventional, and has reference to the Kittim (Cethim) of Genesis x. 4, son of Javan, from whom they are supposed to be descended. (Rev. A. H. Sayce, *Journal of the Royal Asiatic Society*, 1882.)

Hadley, BENJAMIN, son of the headmaster of the Norwich grammar school, was born in 1676, and became a fellow of St. Catherine Hall, Cambridge. Having taken holy orders and obtained preferment in London, he plunged into the controversy in which Atterbury was engaged as to the doctrine of non-resistance and the subordination of Church to State. His advocacy of anti-clerical doctrines was so much appreciated by Parliament that he was specially recommended to Queen Anne for promotion. On the accession of George I. he was made Bishop of Bangor, and in that capacity started the Bangorian controversy. His views were condemned by the Lower House of Convocation, and, to obviate any further discussion, the debating of any but formal matters was forbidden to that body for more than a century. He was raised successively to the sees of Hereford, Salisbury, and Winchester, and he lived to enjoy the revenues of the latter till 1761.

Hoang-ho, WHANG-HO, or YELLOW RIVER, one of the greatest of Chinese rivers, rises in the mountains^s of Tibet (lat. 34° N., long. 98° E.), and flowing N.E. traverses the province of Karsu and enters Chinese Tartary; then, sweeping round, it takes a course due S., dividing the province of Shense from that of Shanse. Finally, with a sharp bend to E. and N.E., it passes through Honan and Shantu, and empties the mass of yellow mud, from which its name is derived, into the Gulf of Pe-chi-li. Though it has a length of 2,500 miles and very considerable breadth, it is for the most part too shallow for navigation, and its liability to floods renders dykes necessary in many places. Tsinan and Kaifong are the chief cities on its banks.

Hoar-frost is the result of deposition of dew from the atmosphere at a temperature below that

of the freezing-point of water. The dew is thus not deposited as liquid, but as a crystalline solid, and aggregations of such solid particles produce various beautiful effects, sufficiently well known to need no description. [DEW.]

Hoaxin, HOATZIN (*Opisthocomus cristatus*), a reptilian bird from the northern parts of South America, constituting Huxley's group Heteromorphe. It is about 2 feet long, arboreal in habit, frequenting low bushes and shrubs on the banks of lagoons, feeding chiefly on the leaves of a species of Arum. The general plumage is greyish-brown, with white markings, and there is a long, flowing crest of narrow pointed feathers. It is also called the Touraco.

Hobart Pasha, the HON. AUGUSTUS HOBART HAMPDEN, third son of the sixth Earl of Buckinghamshire, was born in 1822, and entered the Royal Navy early, serving with gallantry in the suppression of the slave-trade until 1845, when he was appointed to the royal yacht. In the Crimean War he obtained active command of the *Driver*, and did good work at Bomarsund and Sveaborg. Retiring on half-pay in 1860, he took a spell of blockade-running on the coast of North Carolina, and at the end of the War of Secession offered his services to Turkey, and suppressed the Cretan insurrection of 1867. He was now made a Turkish admiral, and undertook the reorganisation of the Sultan's navy; but as he was employed against our allies, the Greeks, his name was struck off our Navy List, and not restored until 1874. However, he incurred the same penalty three years later, when he had to command the Ottoman fleet during the Russian invasion. In 1881 he was created Mushiir and Marshal of the Empire, and in 1885 not only was he recognised by our service, but he further received the rank of vice-admiral. He died very suddenly in 1887.

Hobart Town, the capital of Tasmania or Van Diemen's Land, was so named by the founder, Colonel Collins, in 1804, in honour of Lord Hobart, then Colonial Secretary. It stands about seventeen miles from the mouth of the river Derwent, stretching over a number of hills beside Sullivan's Cove, with Mount Wellington (4,166 feet) as a background. The Governor's residence is in the suburbs, and besides the Houses of Parliament, town hall, and museum, there are many fine buildings both public and private. It is the seat of an Anglican and a Roman Catholic bishopric. Ships of largest tonnage can enter the harbour, and a large export and import trade is carried on, whilst there is regular steam communication with the other States in the Commonwealth and with England. The chief local industries are brewing, tin-smelting, flour-grinding, and timber-sawing.

Hobbema, MEINDERT, a great Dutch landscape painter, of whose personal history little is known, except that he was a pupil of Jacob Ruysdael, and flourished from 1638 to 1709. Unlike his master, whom he surpassed in warmth of colour and freedom of treatment, he sought his subjects exclusively in his native country, and chiefly in the provinces of

Drenthe and Gelderland. He excels in depicting gloomy forest scenery with glints of sunshine, the foliage being rendered with marvellous fidelity. The figures introduced into his pictures are often the work of Berghem, Van de Velde, and other contemporaries.

Hobbes, THOMAS, born in 1588, was brought up by his uncle, who sent him to Magdalen Hall, Oxford. There he seems to have learned little but contempt for scholastic pedantry and aggressive Puritanism. In 1608 he became tutor to William Cavendish, Baron Hardwick, afterwards Earl of Devonshire, and accompanied him abroad for some years, acquiring thus a knowledge of the new intellectual forces that were breaking up throughout Europe the barren system of the schoolmen. Under the influence of this awakening spirit, he resolved to make himself a classical scholar, and in this aim he persisted until 1629, when he published his translation of Thucydides, work of considerable merit. For a time, meanwhile, he had been one of Bacon's secretaries, and had been much esteemed by him. His friend and pupil having now died, he again set out on a foreign tour with a youth named Clifton, and in the course of his reading became for the first time acquainted with Euclid's *Elements*, which gave a fresh impulse to his speculations. In 1631 he was called upon to take charge of the third Earl of Devonshire, son of his old pupil, and three years later set out with him for Italy and France, visiting Galileo and starting a correspondence with Descartes. By this time his mind was gradually shaping itself to definite ends, and at the age of fifty he had worked out the ground-plan of a novel philosophical system in which physical, metaphysical, moral, and political laws were to be explained as dependent upon motion, without which none of the phenomena of Nature could be distinguished by sense. As, however, the events of his time and the circumstances of his own life gave his thoughts a political bias, he began to construct his philosophical fabric from the top, and the earliest completed portions of the scheme were *Human Nature* and *De Corpore Politivo*, in which authority—meaning for the moment the sovereignty and royal prerogative—is recognised as the basis of government and society. Neither of these works was published till ten years later, but they were read and talked about, so that the author deemed it advisable to retire to France when the Parliamentary cause showed its strength. He remained for eleven years in Paris. Meanwhile he worked at another instalment of his work, the *De Cive*, which was published at Amsterdam in 1647, though completed long before. With a view to adapting his theories to current events and to appealing to a larger audience, he next composed his famous *Leviathan*, the leading idea of which is that all individual human beings are built up into one gigantic organism, the State, the cementing power being self-interest only, and all civil and ecclesiastical authority being centred in the crowned head. Thus the work is virtually a defence of absolute monarchy against the Puritans, and of the Royal supremacy against Catholics and

Independents. Hobbes went home once more in 1652, when he was welcomed by his old pupil the Earl of Devonshire; in 1655 he produced *De Corpore*, the treatise with which his life's labour should have begun, but this was preceded by one of his most brilliant essays, *Of Liberty and Necessity*, in which he combated the doctrine of freedom of the will. About 1674 he retired to Chatsworth or Hardwick, and such was his vigour that he composed *Behemoth: or, a History of the Civil Wars from 1640 to 1660*, and translated the whole of the *Iliad* and *Odyssey*, though long past eighty. He was hard at work when paralysis struck him down in his ninety-second year (1679).

Hobby. [FALCON.]

Hoboken, a city and port on the Hudson river, New Jersey, United States of America, adjoining Jersey City and opposite to New York, with which it is connected by a steam-ferry. The name was brought from Holland by the original Dutch settlers. Picturesquely situated, the place is a favourite resort in summer, and a considerable ship-building and iron-founding industry is carried on, besides a large coal trade. Among public buildings the Stevens' Institute of Technology deserves special mention.

Hoccleve, or OCCLEVE, THOMAS, an early English poet, was probably born about 1370, studied law at Chester's Inn, and was writer to the Treasury in the reign of Henry V. From his *De Regimine Principum* it may be gathered that he was a friend of the young princes, and he has left us the only contemporary portrait of Chaucer. His chief work, *The Story of Jonathan*, is pronounced by Hallam to be a feeble and frigid performance.

Hoche, LAZARE, born in 1768, enlisted at the age of sixteen, and soon rose to be a sergeant in the French Guards. His first distinction was won by protecting the queen against the mob, but he adopted the cause of the Revolution, fought bravely at Thionville and Neerwinden, and as general of brigade assisted Souham in defending Dunkirk against the Duke of York. The command of the army of the Moselle was now given to him, and though unable to prevent a junction between the Austrians and Prussians, he defeated the former at Weissenburg (1793). Robespierre caused him to be thrown into prison, but at the end of the Terror he was liberated and sent to pacify La Vendée and Brittany. Here he was quite successful, and his next duty was to lead the futile expedition of 1796 against Ireland. In the following year he succeeded Jourdain in the command of the army of the Sambre and Meuse. On the eve of a decisive victory the Peace of Leoben put an end to hostilities. Six months later Hoche died very suddenly at the age of thirty-three.

Hodgkinson, EATON, was born in 1789, and was educated with a view to the Church, but, under the influence of Dr. Dalton, he turned his attention to mechanics. His researches into the laws that govern the resistance of materials to strain or pressure, conducted with the aid of Sir W. Fairbairn, marked a new epoch in railway engineering.

In 1841 he was made F.R.S., and in 1847 was appointed professor of engineering in University College, London. Stephenson entrusted to him the experiments that preceded the construction of the Britannia Tubular Bridge. He died at Manchester in 1861.

Hodograph in kinematics is a curve of velocities. If a point move along any path its speed at any point has a definite value, and it is then moving in a definite direction, tangentially to the curve at that point. If from any convenient point lines be drawn representing in magnitude and direction the velocities of the actual moving point along its path of motion, the extremities of these lines will be a series of points forming a new curve. This is called the hodograph, and the rate of motion of the hodograph point measures the acceleration, or rate of change of velocity of the moving point. The hodograph of a projectile is a straight line; that of any planet, in regard to its motion round the sun, is a circle.

Hodson, WILLIAM STEPHEN RAIKES, son of an Archdeacon of Stafford, was born in 1821, and, joining the Indian army in 1845, went through the Sutlej campaign, and distinguished himself at Sobraon. As commandant of the Guides Corps he did excellent work in 1852-53 against the Black Mountain tribes and the Afridis. On the outbreak of the Mutiny he raised the corps known as Hodson's Irregular Horse, which took an active part in the operations before Delhi. He captured two of the young princes, whom he shot to prevent their rescue, an act which provoked considerable discussion. He was killed at the capture of Lucknow in 1858.

Hoeven, VAN DER, JAN, was born at Rotterdam in 1801, and studied medicine at Leyden, where, after practising for some years as a physician, he became, in 1835, professor of zoology. His *Manual of Zoology*, translated into English in 1854, was long regarded as one of the best text-books of that science. He died in 1868.

Hof, or REGNITZHOFF, a town in the circle of Upper Franconia, Bavaria, on the left bank of the Saale, 32 miles N.E. of Bayreuth, and at the junction of several railways. As the administrative centre of the district, it contains the usual public institutions, including an ancient hospital dating from the 13th century. The manufacture of cloth and cotton goods and the working of marble and iron are the chief industries. Founded in 1080, the town passed through many historical vicissitudes until its final annexation by Bavaria in 1810.

Hofer, ANDREW, born at St Leonhard, in the Passeier Thal, Tyrol, in 1767, succeeded to his father's business as an innkeeper and dealer in wine and horses. When in 1796 the French invaded the country, he was at the head of a company of volunteer riflemen, and to him was chiefly due the organisation of the military resources of the Tyrol, the negotiations with Austria, and the rising against the French and Bavarians in 1809. He was so successful at Sterzing and Innsbruck that, after the defeat of the Austrians at Wagram, he resolved to continue

the struggle, and for some time kept the enemy at bay. Finally compelled to submit, he took up arms again on hearing that Austria was in the field, but his followers never rallied to him, and he was caught in the mountains through the treachery of Donay, a priest, brought to Mantua, tried by court-martial, and shot, contrary to its sentence, February 20, 1810, at the express order of Napoleon.

Hoffmann, AUGUST HEINRICH, born at Fallersleben in Lüneburg, 1798, completed his education at Bönn and Göttingen, and became in 1830 professor of language and literature at Breslau, whence he was expelled in 1842 owing to the Liberal tone of his *Unpolitische Lieder*. Though restored to favour after the Revolution, he never resumed teaching, but maintained himself by literature, excelling as a song-writer and an investigator of early German philology. His *Songs for Children* may be regarded as his best work. In 1860 the Duke of Ratibor appointed him his librarian, and this position he held at his death in 1874. He is often spoken of as Fallersleben.

Hoffmann, ERNST THEODOR WILHELM, was born at Königsberg in 1776, and, his parents having separated, the wayward but intelligent child was brought up rather erratically. He showed great versatility of talent as a musician, a painter, and a romancist, but for profession adopted the law. In 1806 he seems to have lost his official position, and for eight years he struggled on in great poverty as a composer, teacher, and theatrical director. When peace came in 1814 he received a legal post at Berlin, and died in 1822. His first and most remarkable work is the *Phantasiestücke*, for which Jean Paul Richter wrote an introduction.

Hoffmann's Violet, a fine violet dyestuff, closely related in its chemical nature to the well-known dye *fuchsin* (q.v.) or *magenta*.

Hofmann, AUGUST WILHELM, F.R.S., born at Giessen in 1818, became assistant to Liebig, and was appointed to a chemical professorship at Bonn, whence, at the age of twenty-seven, he was transferred to London as superintendent of the Royal College of Chemistry, and ultimately of chemist to the Mint. In 1865 he returned to Germany to fill the chair of chemistry in the university of Berlin. He has written several valuable treatises on organic chemistry, and his *Introduction to Modern Chemistry* is a valuable educational work, but his fame rests mainly upon his discovery of aniline and its utilisation in the arts for the production of a new series of colours. He died in 1892.

Hog, a gelded pig. [BOAR, PIG.]

Hogarth, WILLIAM, was born in 1697. He had a taste for drawing, and was apprenticed to a silversmith as engraver. In 1718 he set to work upon copper, executing book-plates and other modest designs, but finding time to improve his knowledge of drawing and painting and to cultivate that invaluable gift—a power of retaining impressions once gathered by the eye. His own disposition and the circumstances under which he worked inclined him towards satire. One of his

earliest known efforts is *The Lottery*, a skit on South-Sea speculation, and then follow masquerades and operas (1724), some caricatures of Kent, the architect, and illustrations of Butler's *Hudibras*. He next took to painting portrait groups, which sold readily, and in 1729, being in receipt of a small income, he ran away with the only daughter of his master, Sir J. Thornhill, R.A. For five years he produced nothing of great merit, but it is certain that he was at work upon the series of moral pictures which were destined to make him famous, and in 1734 appeared *The Harlot's Progress*, achieving at once a marvellous success. *The Rake's Progress*, brought out in the next year, was not quite so popular, but the subscription for the engravings of both amounted to a handsome sum. A number of paintings and plates appeared during the nine ensuing years. In 1744 *The Marriage à la Mode* in six scenes showed a remarkable development of his talent; yet as pictures these splendid performances turned out unprofitable. The engravings sold well enough, but the canvases fetched beggarly prices. On the other hand, he was well paid for portraits, such as those of Garrick and Lord Lovat, and he earned a good deal of money by the plates of *The Stage Coach*, *The Industrious and the Idle Apprentice*, *The Election*, *The March of the Guards to Finchley*, *Beer Street*, *Gin Lane*, and *Calais Gate*. He died in 1764.

Hogg, JAMES, "The Ettrick Shepherd," was born in 1770, in Ettrick Forest, and from his mother, Margaret Laidlaw, he inherited a taste for ballad poetry and ancient traditions. Owing to his father's ruin, he had, as a mere child, to seek his own livelihood, and in 1790 found himself in the service of Mr. Laidlaw of Yarrow, who fostered his turn for verse and introduced him to Sir Walter Scott. His first effort, *The Mistakes of a Night*, appeared in 1794, and a rather poor volume of collected poems saw the light in 1801. *The Mountain Bard*, six years later, gave promise of better things, but the little profit that resulted was lost in farming. He now started as a literary man in Edinburgh, and *The Queen's Wake* (1813), by far his ablest work, brought him into notice. He died 1835. *Kilmenny* is an admirable fairy-tale, and *The Shepherd's Calendar* testifies to his ability as a writer of prose.

Hoggar (properly AHAGGAB), a large branch of the Tuaregs (Saharan Berbers), who occupy the Ahaggar uplands and roam thence in all directions along the caravan routes. They form a confederacy of fourteen noble tribes and of numerous pastoral, trading, and agricultural tribes, who are treated as serfs, though all alike claim descent from a common mother-tribe, the Kel-Ahamellen, whose territory lies between Ahaggar and the Twat oasis. Some of the Hoggars were implicated in the massacre of the French expedition, under Colonel Flatters, which was despatched from Algeria in 1882 to explore the Central Sahara. (H. Duveyrier, *Les Tuaregs du Nord*, Paris, 1864; F. Bernard, *Quatre Mois dans le Sahara*, 1884.)

Hog Rat (CAPEBOMYS), a genus of Rodents of the family Octodontidae, with two species from Cuba, and one from Jamaica. They are nocturnal

animals, partially arboreal, and live chiefly on vegetable food. The total length is about 22 inches. The long harsh fur is a mixture of black and yellow hairs, the belly is rusty yellow, and the tail is stout and rat-like. The negroes hunt these animals for the flesh, of which they are very fond.

Hogue, BATTLE OF LA. In May, 1692, James II., with the assistance of Louis XIV., had collected at Cape La Hogue a large army for the invasion of England. To clear the Channel for its passage, a formidable French fleet, under Tourville, was sent to sea. This was met off Cape Barfleur and engaged on May 19th by the combined Anglo-Dutch squadrons, under Admiral Edward Russell; and on that and the three following days about half the French force was destroyed either off Cape Barfleur or off La Hogue, thanks largely to the superior strength of the allies.

Hohenlinden, a Bavarian village, 20 miles east of Munich, made memorable by the victory won by Moreau, in command of the French, over the Austrians, under the Archduke John (Dec. 3, 1800)—a victory rendered famous in England by Campbell's spirited lyric.

Hohenschwangau, the name at present borne by a castle occupying the site of the ancient Schloss Schwanstein on the river Lech in South Bavaria. It was acquired by Maximilian II. of Bavaria, then Crown Prince, in 1832, and rebuilt by Quaglio and Ohrmüller in mediæval style, many distinguished artists being employed in the internal decorations. The late King Ludwig, however, abandoned it for another isolated palace erected close by and called Neuschwanstein, where he spent much of his time in eccentric seclusion.

Hohenstaufen, the name of a dynasty which occupied the imperial throne of Germany from 1138 to 1254. In the 11th century Frederick von Staufen, son of Frederick von Büren, was rewarded by the Emperor Henry IV. with the hand of his daughter and the Duchy of Swabia. His younger son Konrad, Duke of Franconia, after a long struggle with Lothar of Saxony, was ultimately elected Emperor in 1138, and was followed by his nephew, Frederick I., Barbarossa, 1152; Henry VII., 1190; Philip I., 1198; Frederick II., 1212; Conrad IV., 1251-54, when the imperial authority was for a time abrogated.

Hohenzollern, a principality of Prussia, which extends in a narrow strip between Würtemberg and Baden. Its total area is 440 square miles, most of it mountainous and covered with pine-forests, but the valleys watered by the Neckar and the Danube, with their tributaries, are highly cultivated. The name is traced to the old feudal castle of Zollern, near Hechingen. The principality was divided into two in 1536, the southern and larger portion being known as Hohenzollern-Sigmaringen, whilst the northern part is Hohenzollern-Hechingen, the towns of Sigmaringen and Hechingen being the respective capitals.

Hohenzollern, THE FAMILY OF, traces its origin historically to Count Thassilo of Burchardingen, a Swabian, who built the castle of Zollern

early in the 9th century, and whose descendants, Conrad III. and Frederick IV., founded the Frankish and the Swabian lines of the house. The former prospered in course of time, and in 1415 acquired the Electorate of Brandenburg, which three centuries later was developed into the kingdom of Prussia, and this, again, became the head of the German empire. The Swabian branch has not fared so well. In the 16th century (see above) Eitel Frederick III. and Charles II. formally divided the state, and their descendants received princely rank from the Emperors; and in 1695 both the reigning princes agreed that, in the event of the failure of their issue, the Brandenburg house should inherit. However, in 1849 Prince Frederick William and Prince Charles Anton simultaneously resigned sovereignty to Prussia, reserving only their family estates and the rank of younger sons of the monarchy. More recently the Sigmaringen family came into prominence, owing to the candidature of Prince Leopold for the throne of Spain (1870), the election of Prince Charles to the throne of Roumania (1866), and the adoption of Prince Ferdinand, husband of Princess Marie of Edinburgh, as his heir.

Holacanthus, a genus of Squamipinnes, with forty species, closely allied to, and having the same geographical range as, *Chastodon* (q.v.), and resembling that genus in beauty of coloration. The preoperculum bears a strong spine at its angle, and the single dorsal has from twelve to fifteen spines. *H. imperator*, an esteemed food-fish, which the Dutch call the "Emperor of Japan," and *H. diacanthus*, are the best-known species.

Holbach, PAUL HEINRICH DIETRICH, BARON VON, was born at Heidelsheim, in the Palatinate, in 1723. He appears to have inherited considerable wealth, and, coming to Paris, settled down there as the patron of the Encyclopedists and their allies. Helvetius, Diderot, D'Alembert, Rousseau, Condillac, Turgot, Hume, Wilkes, and Sterne were among his constant guests. Though a man of blameless life and average intelligence, he carried his attacks on religion and morality so far as to shock even Voltaire and Frederick the Great. His principal works are *Le Christianisme Dévoilé*, *Le Système de la Nature*, *Le Système Social*, *La Morale Universelle*, and *Bon Sens*, a popular treatise. Most of these were published anonymously, or under the pseudonym of "Mirabaud." He died in 1789.

Holbein, HANS, THE YOUNGER (1497-1543), a celebrated German painter, was born at Augsburg, probably in 1497. His father, HANS HOLBEIN THE ELDER (d. 1524), an excellent portrait-painter, is now believed to have executed many works which were formerly attributed to his son. Chief among these is the altar-piece of St. Sebastian at Munich, with a picture of the Annunciation on one wing and graceful figures of St. Barbara and St. Elizabeth on the other, surrounded by Renaissance ornament. In early life the younger Hans was much influenced by his predecessors in the new school which was growing up in Swabia and found its centre at Augsburg, especially by Martin Schongauer (d. 1488) and Hans Burckmaer (d. 1531). He appears to

have first visited Basel in 1516, but he did not take up his residence there permanently till 1520. The earliest works which are undoubtedly his include a painting on a table at Zürich, representing the devastation in the shape of household breakages worked by "St. Nobody" (1515); portraits of Jacob Meyer, burgomaster of Basel, and his second wife (1516); and the humorous pen-and-ink designs for Erasmus's *Praise of Folly*, now in the Basel Museum. The fine portrait of Bonifacius Amerbach was produced in 1519. After his return to Basel he found occupation in wall-painting, designing for glass, and illustrating books. A water-colour sketch of the famous *Peasant's Dance*, one of the wall-paintings on a house in the Eisengasse, is preserved in the Basel collection. His series of historical paintings and emblematical figures for the Town Hall was probably discontinued owing to the disturbances caused by the Peasants' War. Between 1515 and 1528 he executed numerous title-pages, ornamental alphabets, and other designs for various Basel printers, besides illustrating several editions of Luther's New Testament (1522-23). To the same period belong also the wonderfully graphic series of allegorical woodcuts called the *Dance of Death*—the most perfect specimens of his skill in the treatment of ideal themes—and the similar series representing scenes from Old Testament history, which are no less remarkable for their realistic vigour. These designs were engraved by Hans Lützelburger. His most important religious pictures are the *Solothurn Madonna* (1522), probably painted for the cathedral of Solothurn, and the *Meyer Madonna*, in which the burgomaster and his family are represented in adoration before the Virgin and infant Christ. Two portraits of Erasmus belong to the year 1523. Late in 1526, or early in 1527, he came to England, and appears to have remained in this country for about eighteen months. From Erasmus he received an introduction to Sir Thomas More, in whose house he seems to have spent the greater part, if not the whole, of his time. He now began the series of portraits of English celebrities which perhaps constitute his chief title to fame. The oil-paintings of this period include those of Archbishop Warham; Nicholas Kratzer, the royal astronomer; Sir Henry Guildford, Master of the Horse; and the *Family of Sir Thomas More*, the original sketch for which is preserved in the Basel Museum. During his residence in Basel from 1528 to 1531 he produced a picture of his own family (1529) and two portraits of Erasmus—one a painting, the other a woodcut (1530)—and completed the decoration of the Town Hall by adding paintings representing the colloquy between Rehoboam and the Israelites and the meeting of Samuel and Saul. After his return to England in 1531 he was much employed by the Hanseatic League, and painted several portraits of the Steelyard merchants, one of which—that of Jörg Gyze—has been warmly praised by Mr. Ruskin. The allegorical pictures the *Triumph of Riches* and the *Triumph of Poverty* were painted for the Steelyard on the occasion of Henry VIII.'s marriage to Anne Boleyn (1533). To the same year belongs the painting at Longford Castle called the *Scholars*, the figures in which are

said to be Sir Thomas Wyatt and John Leland. After his entrance into the king's service in 1536, Holbein painted a cartoon in fresco with figures of Henry VIII., Jane Seymour, Henry VII., and Elizabeth of York, and a beautiful half-length portrait of Jane Seymour, now in the Belvedere in Vienna. He was twice sent abroad by the king to paint portraits of ladies whom he proposed to marry, and his pictures of Christina of Denmark (1538) and Anne of Cleves (1539) rank amongst his choicest works. Of his numerous other portraits mention must be made of those of Hubert Morett the goldsmith, Thomas Howard, Duke of Norfolk, and of the picture entitled *The Ambassadors*, recently acquired by the National Gallery. Many of these portraits, or of the sketches for them, are preserved in the royal collection at Windsor. Holbein's death, which was caused by the plague, is now ascertained to have taken place in 1543.

Holberg, LUDWIG, BARON (1684-1754), Danish man of letters, was born at Bergen, in Norway. After studying at Copenhagen, he travelled in England (where he passed two years at Oxford), Holland, France, and Italy. He was successively appointed professor of metaphysics (1718), eloquence (1720), and history (1730) in the university of Copenhagen, of which he became rector in 1735. His genius was first displayed in poems of a satirical character, chief among which was the serio-comic epic *Peder Paars* (1720), directed against his countrymen. After the establishment of a theatre at Copenhagen (1721), he turned his attention to comedy, and wrote several plays, which were acted with much success. His other works include a *History of Denmark*, a humorous romance entitled *The Subterranean Travels of Niels Klim* (1741), and an *Autobiography* (1727-43).

Holcroft, THOMAS (1745-1809), dramatist and novelist, born in London, was the son of a shoemaker, who sometimes gained a livelihood as a pedlar and by letting out horses. After abandoning in turn the occupations of a stable-boy, a cobbler, a schoolmaster, and a strolling player, the younger Holcroft produced a play called *The Crisis*, which was acted at Drury Lane in 1778. Besides numerous comedies, of which *The Road to Ruin* (1792) was the most popular, and several translations, he wrote four novels, in the first of which, *Alwyn* (1780), he described some of his own adventures. In consequence of his sympathy with the French Revolution he was in 1794 imprisoned on a charge of treason, together with Thomas Hardy and others, but he was dismissed without being brought to trial. His *Memoirs*, begun by himself and completed by Hazlitt, are described by Moore as "amongst the most interesting specimens of autobiography we have."

Hold, the whole interior cavity of a ship, especially that part of it between the inner bottom and the lower deck. It is generally used to contain ballast, water, and stores, and in merchant-ships it affords the chief stowage for the cargo.

Holden, SIR ISAAC (1807-1897), inventor, was born in Renfrewshire. After working in a cotton-mill, he became an assistant-teacher, and,

whilst engaged in giving lessons in chemistry at Reading, discovered the principle of the lucifer match (1829). In 1846 he started a mill of his own near Paris, in conjunction with a Mr. Lister. His partner subsequently withdrew, and the works were transferred to the neighbourhood of Bradford. He first entered Parliament in 1865, but retired in 1895.

Holectypus, a sea urchin common in the oolitic limestones and clays of England. It has a low rounded or conical form, a large mouth with the anus on the lower side or just on the lower angle of the margin. The interesting point about the genus is the possession of jaws, which in the allied *Galerites*, etc., are absent.

Holidays. The number of holidays (*i.e.* "holy days") which had their origin in religious observances [**FESTIVALS**] has been reduced to two, exclusive of Sundays—viz. Christmas Day and Good Friday, but new public holidays have been created by recent legislation. [**BANK HOLIDAYS**.] When a bill of exchange falls due on a bank holiday it becomes payable on the following day. No other holidays are recognised by the State.

Holinshed, RAPHAEL (d. 1580?), chronicler, was probably the son of a landed proprietor in Cheshire. Soon after the accession of Elizabeth he came to London, and obtained work under Reginald Wolfe, the royal printer, whom he assisted in preparing the descriptions of England, Scotland, and Ireland, based on the MSS. of Leland, which were to form part of his *Universal Cosmographie*. After the death of Wolfe (1573) this large design was abandoned, but Holinshed, in conjunction with William Harrison (q.v.) and Richard Stanihurst, was instructed to proceed with the parts relating to Great Britain. *Raphael Holingeshe's Cronycle* was published in 1578, his own contributions consisting of the history of England to 1577, of Scotland to 1571, and of Ireland from its conquest to 1509. A new edition with continuations and insertions appeared in 1586 after his death. During the latter part of his life he appears to have been steward to Thomas Burdet of Bramcote in Warwickshire. Holinshed was diligent in the search of authentic materials, and his work may be accepted as a trustworthy source of historical information. A further interest attaches to it from the fact that it furnished the plots of Shakespeare's historical plays and other Elizabethan dramas.

Holl, FRANK, R.A. (1845-88), was the son of Francis Holl, A.R.A., a well-known London engraver. In 1863 his *Abraham about to Sacrifice Isaac* won the gold medal awarded to students by the Royal Academy. He was elected A.R.A. in 1878, and R.A. in 1883. After 1880 he devoted himself mainly to portrait-painting, a sphere in which he earned the greatest distinction. Among his best portraits are those of General Roberts (1882), the Duke of Cambridge, Lord Wolseley, and Mr. Bright (1883).

Holland, the popular name of the Netherlands, a maritime kingdom situated between lat. 50° 46' and 53° 34' N., and long. 3° 22' and 7° 14' E. It is

bounded by the North Sea on the north and west, the kingdom of Prussia on the east, and Belgium on the south, and comprises an area of 12,744 square miles, exclusive of the grand-duchy of Luxemburg which was long included, but has been an independent grand-duchy since the death of William III. in 1890. Its greatest length from north to south is 195 miles, and its greatest breadth from east to west 110 miles.

Political Divisions and Population. Holland is divided into the following eleven provinces:—

Province.	Area in square miles.	Population, 1909.	Capital.
North Brabant...	1,980	620,000	Hertogenbosch, or Breda.
Drenthe...	1,030	178,000	Assen.
Friesland...	1,282	848,000	Leeuwarden.
Groningen...	790	381,000	Groningen.
Guelderland...	1,965	640,000	Arnhem.
North Holland...	1,070	1,104,000	Haarlem.
South Holland...	1,186	1,868,000	The Hague.
Limburg...	850	385,000	Maastricht.
Overijssel...	1,291	880,000	Zwolle.
Utrecht...	584	286,000	Utrecht.
Zeeland...	690	222,000	Middleburg.
Total ..	12,048	5,827,000	—

The population, taken on the basis shown above, gives an average of 460 per square mile. In South Holland, however, there are over 1,000 inhabitants per square mile, and the population of North Holland is hardly less dense. Rather less than one-third of the whole population is urban. The four largest towns are Amsterdam, the capital (population 564,186), Rotterdam (390,364), The Hague (248,995), and Utrecht (114,692). Groningen, Haarlem, and Arnhem have each about 60,000 inhabitants.

Physical Aspect and Climate. The surface is everywhere flat, consisting for the most part of alluvial deposits dropped by the Rhine, Maas, and Scheldt on their way to the North Sea. The greater part of the country is below the level of the sea and watercourses, the difference along the coast amounting in many places to 20 or 25 feet. In the highest districts—such as the Veluwe in Guelderland—the land does not rise more than about 350 feet above the sea-level. In most places the encroachments of the ocean can be kept out only by means of stout dykes or embankments constructed of earth, sand, and mud, and covered with plaited osiers, the gaps between which are filled with clay. They are often planted with trees, in order that the roots, striking downwards, may render the rampart more secure; in other cases the sides are protected by masonry. Dykes are necessary as a defence against the swollen rivers as well as the sea, and, as fresh alluvial deposits are always being formed, they require to be constantly raised in height. The largest dykes are those of the Helder at the northern extremity of North Holland, and of Westcapelle on the island of Walcheren. The canals, which intersect the whole country and are said to have a total length of 1,907 miles, serve a threefold purpose. (1) They are used for communication and traffic,

connecting the innumerable branches into which the great rivers divide themselves, and thus forming a means of access from one extremity of the country to the other. The old method of navigating the canals by means of *Trekschinten*, barges for passengers drawn by horses or men, is now dropping out of use. (2) They drain the superfluous water from the land. For this purpose mills are placed along them at intervals, and the hydraulic works connected with these are constructed in such a manner that they can also be employed for irrigation. Corn, paper, timber, and tobacco mills are also abundant. These curious mills, with their round tops and huge sails, are a very striking feature in the landscape. (3) Canals are also used, as hedges and walls are in other countries, to mark the boundaries of fields and gardens. The chief canals are the North Sea Canal, connecting Amsterdam with the North Sea, the North Holland Canal, from Amsterdam to the Helder, which is 42 miles long, 43 yards wide, and 20 feet deep, and the Willems Canal in North Brabant. The most fertile land of Holland is that in the beds of the "polders," tracts formed by draining marshes or lakes. The largest of these, the Haarlemmer Polder, reclaimed in 1840-53, extends over 72 square miles and supports 10,000 inhabitants. Other important polders are the Purmer (1608-12), Beemster, Schermer, and that of the Y, all in North Holland. A project is now under discussion for draining the Zuyder Zee. The construction and maintenance of dykes, canals, and polders is entrusted to a special department of the government, called the Waterstaat. Along the coast the "dunes," sandhills varying in height from 30 to 160 feet, form a characteristic feature in the scenery. Those situated farthest inland have been gradually taken into cultivation. The climate of Holland resembles that of England, but it is somewhat hotter in summer and colder in winter.

Government and Statistics. The Dutch Constitution was formulated in 1848 and revised in 1887. The legislative power is vested conjointly in the sovereign and the States-General, which is composed of two Chambers. The First Chamber consists of 50 members elected by the provincial councils for a period of nine years, from amongst the citizens who are most highly assessed, or who have occupied or occupy some important public position. The 100 members composing the Second Chamber are elected by direct suffrage. The electoral body, which includes about 843,500 (1909) persons, consists of all male citizens over 25 years of age, and not specially disqualified, who pay a ground-tax of a little over a guilder or florin (= 1s. 8d.) or a personal tax estimated as equivalent in amount, or who can be classed as lodgers by the terms of the law. Members of the Second Chamber receive an annual salary of about £166. The right of initiating legislation belongs to the Second Chamber alone, and the First Chamber is merely empowered to accept or reject Bills, not to amend them. The executive power is in the hands of the sovereign and nine responsible ministers, their respective departments being—(1) Foreign Affairs, (2) Interior, (3) Finance,

(4) Justice, (5) Colonies, (6) Marine, (7) War, (8) Public Works, (9) Minister of Agriculture. Ministers may sit and speak in either of the Chambers, but they have no vote. The sovereign is assisted by a "State Council," containing 14 members appointed by the sovereign. 'S Gravenhage (The Hague) is the residence of the Crown and the seat of government. For purposes of local government the 11 provinces are divided into 1,123



MAP OF HOLLAND.

communes. The public revenue amounted in 1909 to £15,400,000, the expenditure to £16,700,000, and the debt to £93,535,000. All religions are tolerated, and several receive assistance from the state. About three-fifths of the inhabitants are Protestants, and most of the remainder Roman Catholics, but there are one hundred and five thousand Jews, the majority residing at Amsterdam. Education is compulsory for children from 6 to 13 years of age, but in spite of this fact in 1907 there were 1·8 per cent. of the conscripts who could neither read nor write. The state provides a system of primary education, and defrays about one-fourth of the expense, the remainder being borne by the communes. There are universities at Leyden, Utrecht, Groningen, and Amsterdam. The regular army, on a war-footing, contains about 68,000 men, and is recruited both by conscription and enlistment. The conscripts belong for 8 years to the active army and for 7 years more to the "landwehr," but the period of active service is short under conditions considerably modified in 1908. The defence of the country is entrusted to the "landwehr" and the "landstorm," which is composed of all the able-bodied inhabitants. The navy consisted in

1909 of about 100 vessels, with 8,000 sailors, 2,200 marines, and 850 officers.

Industry. The Dutch are eminently an agricultural people. From the earliest period of their history they have striven with indomitable energy to turn to the best advantage the soil which they hold from nature on so precarious a tenure. At the present time some 2,350,000 acres are still covered by forest, heath, and swamp, while about 3,010,000 acres are devoted to pasture, and 2,150,000 acres to tillage. Large farms predominate in N. and S. Holland, Zeeland, and Groningen; small farms in North Brabant, Limburg, Gelderland, and Overijssel. In 1904, 54·4 per cent. of the total area under cultivation was occupied by peasant proprietors. Dairy-farming is the chief occupation of the rural population, and the country has long been famed for its cattle, butter, and cheese. The disease among cattle and sheep, which reached its height in 1874, gave a temporary check to the exportation of live stock, but this branch of trade is again reviving. The Dutch were slow to adopt improved methods of farming, and their trade suffered in consequence; but there has been an advance in this respect of late years. The chief crops raised are rye, potatoes, oats, wheat, chicory, flax, and tobacco. Tulips, hyacinths, and other bulbs are grown extensively at Haarlem. The only mineral product which exists in any abundance is potter's clay. There are coal-mines in Limburg, and the curious sandstone quarries at Maastricht are of some commercial importance.

The following are the chief manufactures, with the places at which they are carried on:—Woollen goods—Leyden, Tilburg, Veenendaal; linens and damasks—Hertogenbosch; calicoes, table-cloths, etc.—Amersfoort, etc.; silk stuffs and dyed silks—Roermond, Utrecht, etc.; leather, glass, firearms—Maastricht, Delft. Schiedam has long been famous for its gin distilleries. Breweries abound, and the manufacture of liqueurs is an important branch of industry. Margarine is the staple product of North Brabant, and there are now extensive cocoa works at Weesp, near Amsterdam, and elsewhere. Diamond-cutting is still carried on at Amsterdam, but not to the same extent as formerly. The pottery and porcelain industry of Delft, famous in the 17th and 18th centuries, has recently been revived. The number of vessels engaged in the fisheries in 1908 was 5,356. The produce of the North Sea herring fishery realised about £680,000; 2,131,250 kilos of oysters were taken, one quarter of which were exported to England.

Commerce. Foreign trade is practically unrestricted. The duties on manufactured articles seldom exceed 5 per cent. of the value, and in many cases no duty at all is levied. The large volume of trade hardly affords a fair test of the internal resources of the country, for Holland still occupies a leading position in the carrying trade of the world. The value of imports for home consumption was about £108,312,000 in 1890, and £235,333,333 in 1900, that of exports of home produce £90,627,000 in 1890, and £181,760,000 in 1908; 10·5 per cent. of the imports came from Great Britain, 22·2 from Prussia, and 9·6 from

Belgium, while in regard to exports these three countries stood in the ratio of 21·5, 47·0, and 12·9 per cent, respectively. The chief articles exported to Great Britain (in the order of their value) were cotton goods, sugar, margarine, iron and steel goods, silks, leather and leather goods, paper, butter, and cheese.

History. The earliest inhabitants of Holland of whom there is any historical record were the Batavi, supposed to have been a tribe akin to the Catti, who settled in the island of Betuwe between the Rhine and the Waal. After the Romans had reduced the Belgæ, the Batavi became their allies and furnished a contingent to the Roman army. In the 4th century the country was overrun by the Salic Franks, who were soon afterwards followed by the Frisians and Saxons. The Batavi appear to have become merged in the Frisians, who occupied the district along the sea-coast. Towards the close of the 8th century this region was incorporated in the dominions of Charles the Great.

Under the feeble rule of Charles' successors the allegiance of the imperial delegates became merely nominal, and, in cases where the offices were held by laymen, they were usually handed on from father to son. In this manner feudalism grew up in the Netherlands as it did in other parts of the Empire. The most powerful lords were the Count of Holland and Bishop of Utrecht in the north, the Duke of Brabant and Count of Flanders in the south. The commercial stimulus given by the Crusades resulted in the growth of chartered towns, and Bruges became the main dépôt for the spices and other goods of the East. Trade with the Hanseatic League, and the growth of the woollen and linen manufactures, contributed to the prosperity of the Flemish cities. Industry in the Netherlands received no serious check until the various petty fiefs became consolidated under the House of Burgundy, who gained a footing in the country by the marriage of the first duke to the heiress of the Count of Flanders (1384). His grandson, Philip the Good, who ruled the duchy from 1419 to 1467, succeeded in possessing himself of the whole seventeen provinces. He and his son Charles the Bold (1467-77) regarded the Flemish cities merely as a means of recouping their exhausted finances. Mary, the daughter of Charles, granted the "Great Privilege," which has been called the "Magna Carta" of the Netherlands, but after her death (1482) it was set aside by her husband, the Emperor Maximilian, who compelled the Dutch to recognise him as the guardian of his young son Philip. The Great Privilege remained in abeyance under the Spanish successors of the house of Burgundy, who followed the same policy as their predecessors. The Emperor Charles V. increased the misery of the Netherlands by introducing the Inquisition (1550). The first resolute efforts at resistance date from the accession of his son, Philip II. The deliverance of the Netherlands could be brought about only through the influence of some man of commanding will and unbounded patriotism, and this man now appeared in the person of William of Orange (q.v.). In 1559 Margaret of Parma was appointed regent, with a council in which the influence of Orange and

Egmont was counterbalanced by that of Vigilius, Granvelle, and Berlagmont. Exasperated by the severity of the Government the Flemish nobles formed the league of the Gueux (q.v.), which in 1566 wrung from Margaret an "Accord" consenting to the abolition of the Inquisition; but in the following year Alva arrived in the Netherlands with 10,000 men, and at once established his "Blood Council" or "Council of Troubles." Orange, who had escaped, collected troops and gained a victory in Friesland, which was avenged by the execution of Hoorn and Egmont (1568). Holland and Zeeland rose in revolt, and in a meeting of the Estates at Dordrecht, held under the authority of Orange as Stadholder, it was resolved with enthusiasm to follow him as leader in the coming struggle. Orange now endeavoured to unite his forces with those of the French Huguenots, but this design was frustrated by the massacre of St. Bartholomew, and he was compelled to abandon the Southern Netherlands to their fate. Left to struggle alone, the northern provinces gradually achieved their independence, although at first they met with frequent reverses, and it was not till 1581 that they ventured openly to renounce their allegiance to Philip. By the "Act of Abjuration" in that year William became ruler over the newly-formed Dutch Republic, the constitution and extent of which had been settled by the Union of Utrecht two years earlier. In 1584 he was assassinated at Delft by Balthasar Gérard, an agent of Alexander of Parma, who governed the Netherlands from 1578 to 1592. Under his son, Maurice of Nassau, one of the ablest strategists of the age, who held the office of Stadholder from 1585 to 1625, the struggle was continued with increasing success. In 1609 a truce was concluded for twelve years, contrary to the judgment of Maurice, who was forced to yield to the importunity of the Dutch merchants. The interval of peace was mainly occupied by the disputes of the Arminians (q.v.) and the Gomarists, and it was partly on the ground of his Arminian views that Jan van Olden Barneveldt, the Pensionary of Holland, was executed at the Hague in 1619. His death, however, was really due to the machinations of Maurice, who found his ambitious projects thwarted by the independent spirit of the burghers. He was succeeded by his brother Frederic Henry, a skilful general and enlightened administrator, under whose rule the prosperity of the States reached its highest point. The war came to an end a year after his death, when the independence of the Netherlands was formally recognised by the Peace of Westphalia (1648). The period of Maurice and Frederic Henry was one of remarkable naval enterprise and commercial activity. The most remote parts of the world were explored by Linschoten, Heemskerk, Schouten, Lemaire, and a host of other famous navigators. The East and West India Companies, the former of which was established in 1602, rapidly gained possession of the Spanish and Portuguese settlements in both hemispheres. But the foundations of Dutch prosperity were threatened by the progress of her commercial rival, England. Cromwell's Navigation Act forced the Grand Pensionary, John de Witt, who

conducted the Government after the death of Frederic Henry's son William II. in 1650, to engage in a war (1652-54), which was marked by the exploits of Tromp and De Ruyter, but had no permanent results. Another naval war with England (1664-67) was equally indecisive. The attempt of Louis XIV. to gain possession of the Netherlands led to a war with France (1672), in which the neglected Dutch army was no match for the forces of Condé and Turenne, who captured the provinces of Guelderland, Utrecht, and Overyssel. The frenzy of the people found vent in a rising in which De Witt perished, and William III., Frederick Henry's grandson, was raised to the office of Stadholder. William's elevation to the throne of England (1689) did not cause him to neglect the interests of his own countrymen. The Peace of Nymegen (1678) and that of Ryswyk (1697), which terminated the two campaigns against the French, both brought substantial advantages to the Dutch. After his death (1702), his cousin, John William Friso, Stadholder of Friesland and Groningen, became captain-general of the army, but he was never elected Stadholder of the United Provinces. The only result of the War of the Austrian Succession, as far as Holland was concerned, was the virtual extinction of her republic. In 1747 William IV., son of John William Friso, became hereditary Stadholder. The attempts of the State to limit the powers of the Stadholder, William V., were baffled by the intervention of the king of Prussia, and when the French invaded Holland under Pichegru (1794) they were welcomed with enthusiasm. After 11 years' existence the newly-constituted "Bataavian Republic" was converted into a monarchy under the rule of Louis Bonaparte (1806); but the policy of Louis was too liberal for his brother's purposes, and in 1810 Holland was incorporated in the French Empire. At the end of 1813 William, the son of the last Stadholder, was restored with the title of king, and by the Congress of Vienna (1815) Holland and Belgium were formed into a single State under his sovereignty. The difference of the two peoples in language, religion, and temperament rendered any real union impossible, and after the revolution of 1830 Belgium became a separate kingdom. During the revolutionary troubles in 1848 William II. was forced to grant a new constitution. The present queen, Wilhelmina (b. 1880), succeeded her father, William III., in 1890. She was crowned in 1898, her mother having acted up to that time as Queen-Regent. In 1901 she married Prince Henry of Mecklenburg-Schwerin. Princess Juliana, the only child, was born in 1909.

Literature. During the Middle Ages the literary genius of the Dutch displayed itself in numerous romances, fabliaux such as the famous *Reinaert*, and the didactic poetry of Jan Boendale, a writer of the 14th century. The germ of modern Dutch literature is to be found in the *Kamers*, or clubs of the *Rederijkers*, which started early in the 15th century and in the 16th century became centres of literary activity, and the national literature reached its culminating point in the

works of the dramatist and historian Hoofdt (1581-1647), who is regarded by his countrymen as the creator of literary Dutch. But the most famous names of the 17th century are those of the poets Vondel (1587-1679) and Jacob Katz (1577-1660). In the writings of the former critics have discovered curious resemblances to Milton. The historian Brandt belongs to the same period. Latin was still the language of the learned, and Erasmus, Grotius, Spinoza, and Boerhaave wrote nothing in their native tongue. During the 18th century Dutch literature declined, but a new poet of genius appeared in Willem Bilderdyck (1756-1831), who did not live to complete his great epic, *The Destruction of the First World*. Of subsequent writers the most important are J. F. Helmers (1767-1813), author of *The Dutch Nation*, Hendrik Tollens (1780-1856), who produced numerous ballads and patriotic songs, Beets, whose *Camera Obscura* earned for him the title of the Dutch Charles Dickens, and the novelist and poet Hendrick Conscience (1812-83). The Biblical critic Abraham Kuennen (1828-91) earned a European reputation, as did the Greek scholar C. G. Cobet (1813-1888). Amongst living authors the novelist Maarten Maartens holds a high rank. In the literary history of Holland no distinction is made between Dutch writers in the strict sense and Flemish authors who have written in the Dutch language.

Holland, Sir HENRY, BART. (1788-1873), physician, was born at Knutsford in Cheshire. After studying at the universities of Glasgow and Edinburgh he settled in London (1816), where he became an eminent private practitioner. In 1852 he was appointed physician-in-ordinary to the Queen. He was also distinguished as a traveller, and in 1812 published his *Travels in the Ionian Isles, Albania, Thessaly, and Greece*.

Holland, HENRY RICHARD VASSALL FOX, third Baron (1773-1840), was the nephew of Charles James Fox. He engaged at an early age in parliamentary life, and became prominent as a supporter of Fox's policy. Throughout his life he continued to advocate Whig principles, and when his party came into power in 1830 he was made Chancellor of the Duchy of Lancaster. Holland House in Kensington, the residence of Lord and Lady Holland, was one of the chief centres of fashionable and literary life in London.

Holland, REV. HENRY SCOTT (b. 1847), was educated at Eton and Oxford, where he gained high honours. He was made a Canon of St. Paul's in 1884 and, owing to his eloquent preaching, has become one of the leaders of the High Church party, and is a leading Christian Socialist.

Holles, DENZIL (1599-1680), statesman, was the son of the first Earl of Clare. He first entered Parliament in 1624, and immediately joined the opposition to Buckingham. For his share in the proceedings of March 2, 1629, when he forced the Speaker to remain in the chair while resolutions were passed against religious changes and the arbitrary levying of tonnage and poundage, he was

sentenced to a fine of one thousand marks and imprisoned for a time in the Tower. He was one of the "five members" whom Charles unsuccessfully strove to arrest on a charge of treason in January, 1642. He took an active part in the Civil War during its earlier stages, but afterwards advocated peace. Subsequently he became a leader of the Presbyterians in their struggle with the Independents, and, after the close of the war, opposed the claims of the army with so much resolution that he was compelled to withdraw to France. After the death of Cromwell he returned, and took a leading part in the restoration of the Stuarts. He was raised to the peerage as Baron Holles in 1661, resided in Paris as ambassador from 1663 to 1666, and was engaged in negotiating the Treaty of Breda (1667).

Holly (*Ilex Aquifolium*), a British evergreen tree belonging to the order Ilicineæ, with hard, even-grained white wood; smooth ash-grey bark; glossy, dark-green leathery leaves, with a spinous margin when near the ground, but with one spinous point higher up; flowers usually dioecious; and scarlet, or rarely yellow, berry-like but superior fruits, each with four one-seeded chambers. Many variegated varieties are in cultivation. Hollies flourish best on sandy soils, and form an undergrowth characteristic of some of our oldest forest tracts, such as the Forest of Dean, New Forest, and Epping Forest. The holly seems also to be often associated with pre-historic earthworks, and its use in winter decorations, whether of Roman or Teutonic origin, is undoubtedly very ancient. The tree is a valuable hedge plant. The wood is used in inlaying and turning, for ebony-stained tea-pot handles and walking-sticks, etc., and the leaves are employed in the Black Forest as tea, as on a far larger scale are those of *I. paraguayensis*, the maté tea (q.v.) of South America.

Hollyhock. *Althaea rosea*, *chinensis*, and *fici-folia*, are tall-growing perennial herbaceous members of the mallow family introduced into our gardens from the Holy Land. They grow best in a well-manured sandy loam either from seed or from cuttings. Their tall spikes of flowers vary much in colour, being white, yellow, pink, deep-red, violet or almost black, but never a true blue. Some have single and others double flowers. Their stamens are protandrous, and the pollen of each variety apparently prepotent on the stigmas of the same variety, so that these varieties are exceptionally true to seed. The ravages of a mildew (*Puccinia malvacearum*), which attacks the cellular tissue of the leaf, especially in dry seasons, have much diminished the cultivation of this group of plants.

Holman, JAMES (1786-1857), the "blind traveller," entered the navy, from which he was compelled to retire owing to the loss of his sight. He subsequently visited countries in all parts of the globe, and in 1834 published his *Voyage Round the World*.

Holmes, OLIVER WENDELL (1809-1894), American man of letters, was born at Cambridge, Massachusetts, and received his education at Harvard

University. After leaving college he studied medicine, and in 1836 took his degree of doctor in that faculty at Harvard. After holding a professorship of anatomy and physiology at Dartmouth College for two years (1839-41), he settled at Boston, where he afterwards resided. From 1847 to 1882 he was professor of anatomy in the medical college at Harvard. Dr. Holmes published several works on medical subjects, but on this side of the Atlantic he is known chiefly in a literary capacity, and especially as the humorous author of *The Autocrat of the Breakfast Table*, *The Professor at the Breakfast Table* (1860), and *The Poet at the Breakfast Table* (1872). This entertaining series of "table talk" was published in the *Atlantic Monthly*, with which he became connected when it was started in 1857, and in which all his purely literary works written since that date have appeared. Before he made his mark in the *Atlantic Monthly*, Dr. Holmes had already gained some reputation as a poet. His early poems, a collection of which appeared at Boston in 1836, were chiefly occasional pieces of a humorous character. Since then his *Songs in Many Keys* (1862), *Songs of Many Seasons* (1875), and *The Iron Gate and Other Poems* (1880) have shown that he is a graceful writer of lyrics. His other works include *Elsie Venner, a Romance of Destiny* (1861), *Memoirs of J. L. Motley* (1878) and *R. W. Emerson* (1884), *A Mortal Antipathy* (1885), and *Our Hundred Days in Europe* (1887). *Over the Teacups*, published in the *Atlantic Monthly* in 1890, is in the same vein as the *Breakfast Table* papers.

Holmes, SIR ROBERT, naval commander, was born in 1622, and, when young, served in the army of Charles I. In 1649-50 he accompanied Prince Rupert's piratical squadron, and immediately after the Restoration commanded a force on the coast of Guinea. In 1664 he reduced the Dutch African settlements, and captured New York, and during the Dutch War he was present in all the principal battles. In 1666 he was knighted and made a rear-admiral, and in the same year he commanded a squadron which burnt an enormous amount of Dutch shipping in the Vlie. These services procured him in 1669 the governorship of the Isle of Wight. In 1672 he commanded the force which operated against the Dutch Smyrna fleet, and he was present in the *St. Michael* at the battle of Solebay. He died in 1692, and lies buried at Yarmouth, Isle of Wight.

Holmium, a rare metallic element which occurs together with other rare metals in a few minerals—e.g. cerite, gadolinite. There seems to be evidence for believing that, like other so-called elements of the same group (e.g. *Didymium*), holmium is not a true elementary body, but consists of probably four simple and distinct substances.

Holocystis, a genus of corals found in the Lower Greensand of the south of England. The genus is well-known, owing to the fact that the septa are arranged in multiples of four instead of six, and so it was for long included among the

Palaeozoic group, the Rugosa (q.v.). It is, however, now regarded as an ordinary Astrean coral.

Holophote System. [Lighthouse.]

Holometabolic Insects are those in which the metamorphosis is complete, as in the butterfly—i.e. a quiescent resting stage (*chrysalis*) intervenes between the caterpillar and the imago or adult insect.

Holograph, a letter, document, cheque or manuscript, which is wholly written by the person whose signature is appended.

Holostomata, the division of Gastropoda (q.v.) which includes all those with a rounded, unnotched mouth. They belong to the Streptoneura and the subdivision Azygobranchia. [GASTROPODA.] They are all vegetable-feeders, whereas those with a notched mouth (e.g. the Whelks) are mostly carnivorous. The Top-shell (*Trochus*), the Winkle (*Littorina*), the Pondsnail (*Paludina*) are well-known representatives. In order to base the nomenclature on the anatomy of the soft parts instead of the shell, it has been proposed to call the group "Holochlamyda."

Holothurians, or SEA-CUCUMBERS, one of the classes of the Echinodermata. They are elongated and worm-like in form, have soft bodies which may be strengthened by calcareous plates or spicules; they have a circle of tentacles around the mouth, and the madreporite, or opening of the water vascular system, hangs loosely in the interior. They are all marine, and live mainly among coral reefs, though one order (*Elasipoda*) inhabit the deep seas. As with most of the Echinodermata, the organs are arranged on a five-rayed plan. Thus there are five rows of tube feet, arising from five water vascular vessels. These are the usual means of locomotion, but in the *Synaptidae* these are absent, and the Holothurian moves in a worm-like manner. Respiration is usually effected by a circle of tube feet round the mouth, which have been modified to form a number of branched feathery tentacles. At the other end of the alimentary canal is usually one or a pair of "respiratory trees." There is no certain representative of the circles of five plates which form the apical system (q.v.) of other Echinoderms. Owing to this, and the primitive nature of some other characters, many authors have sought in this class for the ancestor of the Echinoderms. The class is divided into three orders:—

1. *Elasipoda*: Primitive deep-sea forms, which are shaped like a slug; no respiratory trees.
2. *Pedata*: With tube feet.
 - (a) *Aspidochirota*: Tentacles with ampullæ; e.g. *Holothuria*.
 - (b) *Dendrochirota*: Tentacles arborescent; e.g. *Cucumaria*.
3. *Apoda*: No tube feet.
 - (a) *Pneumonophora*: Respiratory tree loosely attached.
 - (b) *Apneumona*: No water vascular vessels or respiratory trees.

Holotrichia, an order of Infusoria (q.v.), including all those in which the cilia are uniform in size and are arranged in parallel lines over the whole body. There may be one band of somewhat larger cilia round the mouth.

Holstein was prior to 1866 a duchy in the kingdom of Denmark and also a member of the Germanic Confederation, but since its conquest by Prussia it has, together with Schleswig (q.v.), formed a province of the latter kingdom. It is bounded by Schleswig on the north; the Baltic Sea, Lübeck, and Mecklenburg on the east; Lauenburg on the south-east; the North Sea on the west; and Hamburg and Hanover on the south and southwest. The soil is chiefly sand and clay, and the surface gently undulating; heaths are common in some parts, but elsewhere the land is fertile, especially in the marshy districts. The chief natural products are salt, gypsum, peat, and, on the eastern coast, amber. Agriculture and cattle-rearing form the chief occupations of the inhabitants.

Holt, SIR JOHN (1642–1710), judge, was born at Thame, in Oxfordshire. He was called to the bar in 1663, and some twelve years later began to make his mark as one of the leading counsel of the day. In the State trials which grew out of the alleged Popish and Rye House plots he was frequently engaged on the side of the defendants. From 1689 to 1710 he was Lord Chief Justice of the King's Bench. His unwavering integrity gained him universal esteem.

Holtz Machine is one of the earlier forms of electrical machines for the separation of electricity and the production of such at high pressure or potential. The best modern form is, however, due to Wimshurst, whose machine is described in detail; it is thus unnecessary to explain the Holtz machine, except to remark that it works upon the same principles of induction and accumulation of charges, but is less effective than the Wimshurst machine. [ELECTRICITY.]

Holy Alliance, a league formed by Austria, Prussia, and Russia, in September, 1815, after the fall of Napoleon, with the nominal object of taking religion as their sole guide both in their mutual relations and in the administration of their internal affairs. The real object of the league was to maintain the power of the existing dynasties and to check the growing Liberalism which resulted from the French Revolution.

Holy Grail, sometimes the dish, but more generally the cup used at the Last Supper; there are many legends connected with the search for the grail, and of its miraculous food-producing powers. [GALAHAD, PARISIFAL.]

Holyhead, a small island off the west coast of Anglesey, North Wales, with which it is connected by a causeway. The town of Holyhead, a port and parliamentary borough on the north side of the island, is mainly important as a point of departure for Ireland—Royal Mail express, and cargo steamers sailing to Kingstown, Dublin, and Greenore. The town is situated amid wild and rugged scenery, and is increasingly popular as a watering-place. The harbour underwent great improvements between 1850 and 1880, and the roadstead, which now comprises some 600 acres, is

defended by a stone wall nearly 40 feet high. The inhabitants are mostly engaged in connection with the steamer and railway services. Ship-building, rope-making, and a coasting trade are carried on. Pop. (1901), 20,542.

Holy Island, or LINDISFARNE, an island off the coast of Northumberland, $9\frac{1}{2}$ miles south-east of Berwick-on-Tweed, covering 2,457 acres. At the south-east end there is a castle dating from about 1500. The famous monastery of Lindisfarne was founded in 635 by Oswald, King of Northumbria, who made it the seat of a bishopric, the first occupant of which was St. Aidan. The cathedral was in 1093 converted into a Benedictine priory, of which there are still considerable remains.

Holyoake, GEORGE JACOB (b. 1817), social reformer, was born in Birmingham, where for many years he worked in an iron-foundry with his father. He afterwards adopted the social and religious views of Robert Owen (q.v.), by whose disciples he was sent to various parts of England for the purpose of disseminating his principles. In the course of his wanderings he was arrested at Cheltenham and imprisoned in Gloucester gaol on a charge of atheism (1841). After his release he came to London, and established a printing and publishing office in Fleet Street. He was an active supporter of political and social reforms and, as editor of the *Reasoner* and other free-thought periodicals, did much to promote a spirit of toleration in the discussion of public questions. Mr. Holyoake's name is especially identified with the Co-operative movement, and he took an active share in assisting Garibaldi during the Italian War of Independence. He died in 1906.

Holyoke, a city on the Connecticut river in Massachusetts, United States, eight miles north of Springfield. Paper-making is carried on very extensively.

Holyrood, an abbey and palace in Edinburgh. The Augustinian abbey was founded in 1128 by David I., King of Scotland, in consequence of his miraculous preservation from the attack of a hart, whilst hunting, through the interposition of a hand holding a flaming cross. It was dedicated to the "Black Rood," a golden cruciform casket brought to Scotland by Queen Margaret about sixty years earlier, and supposed to contain a fragment of the true cross. The Black Rood was captured by the English in the battle of Neville's Cross (1346), and deposited in St. Cuthbert's shrine in Durham cathedral, whence it disappeared during the Reformation. The abbey church, much injured by fire during the English invasions in 1544 and 1547, but subsequently repaired, was converted into the parish church of the Canongate during the Reformation, and so remained until 1687, when it became the chapel-royal. It is now in a ruined condition. Holyrood Abbey was a frequent residence of the Scottish kings, even before the foundation of the royal palace in the reign of James IV. (about 1500). From that date to the accession of James VI. to the throne of England it was the principal abode of the Scottish sovereigns. It was almost completely

destroyed by Cromwell's troops in 1650, but was rebuilt by Charles II. Notwithstanding the numerous injuries it has undergone, a portion of the original structure of James IV. still remains. Amongst the historical scenes associated with the palace must be mentioned the murder of David Rizzio (1566), and the balls and assemblies held during the brief sovereignty of the Young Pretender, which took place in the picture gallery. The buildings and precincts of the palace continued to be a place of sanctuary for debtors till within a very recent period.

Holystone, a soft porous stone, used at sea for scouring decks. It is applied with sand and water.

Holy Water, water which has been consecrated to religious purposes through the blessing of a priest. Its use as a symbol of spiritual purification in the early Church was derived from the Jewish observance of washing the hands, but in all religions and at all periods the cleansing properties of water have given rise to the same or similar rites. We know from Tertullian that it was so used by Christians before the close of the 2nd century. The custom of mixing salt with the water arose at a very early period. The use of holy water is now an important feature in the services of the Roman Catholic, Greek, and Eastern Churches. It is placed in benitiers (q.v.) at the entrance to churches that the congregation may sprinkle themselves when passing in and out.

Homaloptera (PUPIPARA), a division of Diptera, the members of which are all parasitic. Such are *Hippobosca*, which lives on the horse; Bee-lice, which infest bees; and Sheep-ticks. *Ornithomyia* occurs on birds, while the family *Nycteribida* infests bats. One of the most interesting points in the group is the fact that the egg stage is suppressed, and the young are born directly as pupæ. These have long spreading legs, and resemble young spiders in appearance.

Homarus, the genus which includes the Lobster (q.v.).

Homberg Phosphorus, a fused mass of calcium chloride, CaCl_2 . If exposed to sunlight, it acquires the property of appearing luminous in the dark, and was called by the above name in honour of the first observer of this fact.

Homburg, or HOMBURG VON DER HÖHE, a Prussian town in the province of Hesse-Nassau, nine miles N.N.W. of Frankfort. It is a favourite health-resort, owing to its five saline and chalybeate springs, which are very efficacious in cases of dyspepsia, gout, rheumatism, skin diseases, and other complaints.

Home, DANIEL DUNGLAS (1833-86), a celebrated spiritualist, was born near Edinburgh. After making several distinguished converts in America, whither he had been taken at the age of nine, he came to London in 1855, and held *séances* which were patronised by Lord Brougham, Sir David Brewster, and other men eminent in politics,

letters, and science. During the next seventeen years he continued to display his skill in England, France, and Italy (where, in 1855, he became a Roman Catholic), but he was not a professional medium, and received no payment for his exhibitions. He died in Switzerland.

Home, JOHN (1722-1808), Scottish dramatist, was born at Leith and educated at Edinburgh University. In 1745, although already a probationer of the Kirk, he joined the royal army as a volunteer, and after the Jacobite victory at Falkirk was imprisoned in Doun Castle, from which he effected his escape. In 1747 he was appointed minister of Athelstaneford in East Lothian. His tragedy of *Douglas* was acted at Edinburgh amidst much enthusiasm in 1756, and, on its production at Covent Garden in the following year, won the approbation of Gray, Sheridan, and Hume. Home now resigned his living and came to London, where he continued to write for the stage. He was appointed private secretary to the Earl of Bute, and in 1760 received a royal pension of £300. In 1779 he settled in Edinburgh. His *History of the Rebellion of 1745* was published in 1802.

Homer. The earliest monuments of Greek literature are two epic poems, the *Iliad* and the *Odyssey*, which, up to a recent period, were universally ascribed to a single author named Homer.

Date, Place, and Circumstances of their Composition. The earliest known attempt to fix the date of Homer is that of Herodotus, who supposed him to have lived about 400 years before his own time, i.e. about 860 B.C. Later writers generally placed him a century or two centuries earlier. When Asia Minor had become the centre of Ionic culture, various cities on the east side of the Aegean laid claim to Homer, but in the Homeric poems this region is still peopled by non-Hellenic races. The various "lives" of Homer are not older than the 2nd century A.D., and have no biographical value. Recourse must thus be had to the evidence furnished by the poems themselves. This is mainly of two kinds (1) historical and geographical, (2) linguistic. (1) The political and social institutions of the Homeric Achaeans, their moral and religious ideas, art, industries, and military tactics, all point to a period earlier than the Dorian invasion, which is supposed to have taken place about 1100 or 1000 B.C. This conclusion is borne out by the latest excavations in Greece, Egypt, and elsewhere, which often illustrate passages in the *Iliad* and *Odyssey* and throw fresh light on their probable date. Many scholars now think that Homer may have lived in the 12th or 11th century B.C. (2) The dialect in which Homer writes is Old Ionic, with a considerable admixture of archaic forms, which otherwise appear only in Aeolic and Doric. The differences between the Ionic of Homer and that of Herodotus and the earliest Attic writers shows that there must have been a long interval between the two periods. As the "Epic dialect" is likewise employed by the Boeotian Hesiod, it had evidently become the recognised language of literature, and its use by Homer does not prove that he belonged to the Ionic stock. It is difficult

to form any idea as to the personality of the author of the *Iliad* and *Odyssey*, or the circumstances under which he wrote. He can hardly have belonged to the same class as the *rhapsodes* ("stitchers of songs"), reciters of epic poetry, who in a later age competed at great festivals, such as the Panathenaea. No grounds can be adduced for supposing that he was a wandering minstrel. The most probable view seems to be that, like his own Demodocus, he was a bard residing at a royal court, but one whose literary character was more distinctly recognised, who exercised higher functions than the casual entertainment of the royal household.

The Homeric Question. A sceptical view of the authorship of the *Iliad* and *Odyssey* grew up gradually during the 18th century. One of the first to maintain that they were collections of loose lays was the Abbé d'Aubignac, whose *Conjectures* were published in 1715. The question whether Homer could write had already been discussed by Casaubon and Perizonius in the 16th and 17th centuries. The contrary opinion, based on a passage in Josephus (90 A.D.), was maintained by Robert Wood in his *Essay on the Original Genius and Writings of Homer* (1775). The reaction in favour of "nature" as opposed to "art"—i.e. to the artificiality of the 18th century—drew the attention of literary men to popular and unwritten forms of poetry: the border-ballads were assiduously studied, and the appearance of Macpherson's *Ossian* (1760-65) suggested the notion that the *Iliad* and *Odyssey* might be compilations of the same character. At the same time, the publication of the Venice MS. (1788), which brought to light the labours of the Alexandrian critics, furnished material for a critical examination of the Homeric text. The original purpose of Wolf's *Prolegomena* (1795) was to ascertain the extent to which the Homeric poems, as we now possess them, have retained their integrity of form. But he was soon led to discuss the larger issues involved, and in doing so he displayed a thoroughly sceptical spirit. The Homeric question is extremely intricate; it will be possible only to indicate briefly the main points in Wolf's arguments and the answers they have received from modern critics. Wolf maintains that (1) writing was unknown during the period assigned to Homer. But it is incredible that a complete epic like the *Iliad* or *Odyssey* should have been produced without its aid. (2) They must therefore have consisted originally of independent lays, which were handed down orally. The means of transmission is found in the *rhapsodes*, mentioned by ancient authors. The *Homerides* are described as a school of *rhapsodes* charged with the preservation of the Homeric poems. Wolf maintains that the *rhapsodes* altered and extended the older lays, thus producing a cycle of poetry which dealt with the siege of Troy and the story of Odysseus. (3) The "Voice of Antiquity" is unanimous in asserting that the lays were collected and written down by the command of Pisistratus, Tyrant of Athens, in the 6th century B.C. (4) Their form, however, was not thereby settled, for numerous changes were introduced by

the *diaskeuasts*, or literary "polishers" of the next generation. (5) As MSS. multiplied, various readings arose, and amongst these the Alexandrian critics selected those which accorded best with their canons of literary criticism. At the same time they excised passages repugnant to their taste and welded the remainder into an organic whole. Thus it is to the grammarians Aristophanes and Aristarchus that we owe the *Iliad* and *Odyssey* in their present form. The progress of criticism and archaeological research have brought discredit on the speculations of Wolf. His arguments are now met by the following contentions: (1) The Greeks early came into contact with the Phoenicians, who possessed an alphabet at a very remote period. The gradual changes observable in the oldest Greek inscriptions, which belong to the 7th and 6th centuries B.C., authorise the belief that the introduction of the Phoenician alphabet took place at a much earlier date. It is unreasonable to suppose with Wolf that, when known, its use was confined to brief inscriptions. He is wrong in supposing that the Greeks possessed no materials available for a lengthy composition, and it is more probable that the didactic poems of Hesiod and contemporary works of a like character were written than that writing came into use with the growth of a prose literature in the 6th century. Finally in the *Iliad* itself Bellerophon carries a missive which may possibly have been a written letter. (2) Our knowledge of the rhapsodes is too slight to support the theory of Wolf. Colleges have existed among various peoples for the purpose of transmitting sacred hymns, but we cannot suppose that the "lays" possessed this sacred character. It is doubtful whether the Homeridae of Chios had anything to do with Homer, while, on the other hand, the word is used by Attic writers to denote all "who busy themselves with Homer," and not any particular guild or clan. Whether the rhapsodes composed the greater part of the *Iliad* and *Odyssey* themselves, as Wolf assumes, or merely handed them on to their successors, it is inconceivable that there ever existed an indefinite number of great poets who all wrote on the same theme in exactly the same style. (4) The "Voice of all Antiquity" consists of vague statements by Cicero, Pausanias, and later writers, and, moreover, they do not assert that he committed the poems to writing, but merely that he "collected" or "arranged" the "books of Homer" or "the separate songs." The same, or a similar task is ascribed on equally good authority to Solon, Hipparchus, and others. The tradition in its various forms has been traced to a literary exercise in the form of an epigram, which is certainly not older than the Alexandrian period. (4) The *diaskeuasts* were not literary "polishers," but interpolators of fictitious lines. The corruptions they introduced into the Homeric and other texts do not, however, seem to have been very extensive. (5) The scholia show that the differences between the MSS. were insignificant, and such knowledge as we possess concerning Aristarchus and his predecessors favours the view that they exercised extreme caution in their selection of readings and earnestly strove to recover the

genuine text. Wolf's speculations were carried further, though on somewhat different lines, by Gottfried Hermann (1832, 1840) and Lachmann (1837, 1841).

The "Separators." Two ancient grammarians who noticed a few trifling points in which the *Iliad* and *Odyssey* differed, rashly asserted that they were not written by the same author. They became known as *Chorizontes*, or "separators." Modern scholars have observed discrepancies of a more serious kind. To say nothing of divergences in mythology and legendary lore, the latter extending to the tale of Troy itself, the *Odyssey* shows a decided advance in moral sentiment and the views entertained of the relations between gods and men. The question remains whether these differences are sufficient to outweigh the uniformity of style which characterises the two poems. The ablest recent defence of Homer against the attacks of Wolf and his followers is Mr. Andrew Lang's scholarly work *Homer and the Epic* (1893).

Homily (Greek, "intercourse") was sometimes used to denote the instruction which a philosopher gave his followers in a colloquial form. It was adopted by the early Church in the sense of a practical exposition of some passage of Scripture, always more or less homely in character. The use of homilies may have been derived from the Jewish practice of expounding the Law and Prophets in the synagogue (*cf.* Acts xiii. 14-48, xvii. 2; Luke iv. 16-22). Originally the sermon (*logos*) differed from the homily as a discourse does from a commentary. In process of time it became customary to draw up collections of homilies by well-known writers for the use of those who were too ignorant or idle to prepare them for themselves. The use of specially-prepared volumes of this kind is prescribed by the Prayer Book in accordance with the ordinances of 1547 and 1559. It is to these particular homilies, now seldom if ever used, that the name has become confined.

Homo-catechol, or **HOMOPYRO-CATECHIN**, $C_7H_8O_2$, is a benzene derivative consisting of *dioxytolnene*, $C_6H_3(CH_3)(OH)_2$. It is a syrupy liquid which is coloured green by chloride of iron. It is closely related to *creosol* [CREOSOTE], which is derived from it by the replacement of one hydrogen atom by the group CH_3 .

Homocercal. [FISHES, vol. iv. p. 305.]

Homocolla, a division of the calcareous sponges, including those in which the gastric cavity is lined throughout by collar cells. It includes the Ascones, *Homodermia* (q.v.), etc.

Homoderma, a remarkable calcareous sponge which grows from a tubular stolon or horizontal stem.

Homœopathy, derived from two Greek words, *homios*, "like" and *pathos*, "a disease." The idea that diseases can be cured by the administration in appropriate doses of drugs which, when given to healthy persons in other doses, produce the disease or a morbid condition resembling the disease, is one which dates from the very earliest

days of the history of medicine. The notion that like cures like is based upon the undoubted fact that certain drugs produce widely differing results when administered in different doses. Thus digitalis when given in small quantities slows the pulse, while the same drug administered in large quantities produces the reverse effect. Again, the contrast in the effects produced by minute and by more considerable quantities of opium or alcohol upon the nerve centres may be cited as a case in point, and several other examples might be given. Early in the present century the doctrine embodied in the phrase "*similia similibus curantur*" was made popular by a German physician, Hahnemann. The system of treatment introduced by him was based upon the assumption that the principle like cures like was capable of a wide general application, and he was led to a belief in the efficacy of extremely minute doses of drugs in the cure of disease. A homeopathic pharmacopoeia soon obtained a definite form, and schools of homœopathy acquired some celebrity in many parts of the world. The doctrine of infinitesimal doses, which was pushed to an extreme by Hahnemann, has been considerably modified by his successors, and the progress of knowledge with respect to the action of drugs has shown that Hahnemann's fundamental principle is by no means capable of being applied in the indiscriminate way which he advocated. While we recognise the absurdity of many of Hahnemann's notions, it must be admitted that he did something to stimulate the study of therapeutics, and it is claimed by homœopathists that their practice has been the means of demonstrating the usefulness of certain drugs, the merits of which would otherwise have been overlooked. In Germany and England homœopathy does not appear to be making much progress, but in the United States it still enjoys considerable popularity.

Homogeneity. This is a term of much general importance in physics. A substance is homogeneous when at all points the properties are exactly the same. Two equal cubes cut from different portions of the substance, with their corresponding edges parallel, would be identical in properties, and could conceivably be interchanged without altering the properties of the mass. Among homogeneous substances may be mentioned glass, water, rock-crystal, and gold. Such are further subdivided into *isotropic* and *æolotropic* substances. The former have the properties exactly the same in all directions; the above cubes could be interchanged in any new positions. Glass and water are isotropic. Æolotropic substances have the properties at any two points exactly the same in corresponding directions; the cubes must be interchanged in such a way as will not alter the aspects of their faces. Rock-crystal, selenite, and most other crystalline substances are examples of æolotropic bodies.

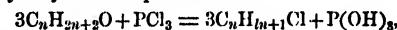
Homogeneous Atmosphere is a conception of some utility. A uniform and homogeneous atmosphere of height about 26,000 feet, and of density throughout equivalent to the present density of the actual atmosphere at the earth's surface, would give a pressure equal to the actually-existing

pressure. Such a state of things does not exist, the air reaching to a far greater height and diminishing continuously in density on account of the smaller pressure bearing upon it as the height is increased.

Homogeneous Light means light of one definite colour only, due to vibrations of one frequency. It is impossible to get pure homogeneous light, but it may be approached very closely with the sodium flame, the constituents of which are two colours in the yellow portion of the spectrum, very nearly of the same frequency. Mixed light may be rendered more nearly homogeneous by filtering away certain of its various ingredients by passing the light through some medium that will only transmit certain colours.

Homologous, a term used in zoology to signify that the two organs resemble one another in origin. Thus the wing of a bird and the arm of a man are homologous. Whereas the wings of a butterfly are analogous, and not homologous to that of a bird.

Homologous Series. Amongst organic compounds a number of series of compounds occur in which each member differs from the preceding by the group CH_2 . These compounds are then said to form a *homologous series*. As examples may be instanced: the hydrocarbons known as *paraffins*, CH_4 , C_2H_6 , C_3H_8 , etc.; the *alcohols*, CH_3O , $\text{C}_2\text{H}_5\text{O}$, $\text{C}_3\text{H}_7\text{O}$, etc.; the *fatty acids*, CO_2H_2 , $\text{C}_2\text{H}_4\text{O}_2$, $\text{C}_3\text{H}_6\text{O}_2$, etc. A very large number of such series exist, and in all cases the members of the same series possess the same characteristic properties, and in their chemical behaviour closely resemble one another. A large number of chemical equations can thus be made general—i.e. applying to a whole series of compounds, and not to one single body only. The equation—



representing the formation of a chloride from an alcohol, is such a general equation. With this general similarity, too, there is a regular variation in properties as the series is ascended. Thus the boiling-points rise regularly, those of the first four alcohols being 66°, 78°, 98°, 117°, while in other series a similar variation is noticed.

Homoptera, the division of Rhynchota (q.v.) which includes all those in which the anterior pairs of wings are of the same texture throughout, as in the Cicadidae, Lantern Flies, Plant Lice (*Aphides*), Scale Insects (*Coccoidea*), etc. The last of these is of great economic value, as the dried females of one species (*Coccus cacti*) forms cochineal, while another (*C. lacca*) yields shellac. As a rule, the members of this group are small and inconspicuous, but a few of the *Membracidae* are fairly large, and resemble butterflies in general aspect.

Homotaxis, a similarity in the general succession of organic types in widely-separated regions, indicating that the strata containing these types have been deposited during the same relative periods in the geological series.

Honduras, a republic of Central America, extending over about 46,500 square miles, and bounded by the Bay of Honduras and the

Caribbean Sea on the N. and N.E., Guatemala on the W., and San Salvador and Nicaragua on the S. and S.E. It has a coast-line of 400 miles on the N. and 50 miles on the S., skirting the Gulf of Fonseca, between San Salvador and Nicaragua. The mean latitude is $14^{\circ} 35' N.$, longitude $86^{\circ} 18' W.$ The country along the sea-shore is swampy and malarious, but in the interior the surface consists of a succession of plateaux, and here the climate is very moderate. The Cordilleras cross the state in a series of almost parallel ranges, running from N.W. to S.E.; in many places the level surface between them becomes hollowed out into rich and well-watered valleys. Honduras was discovered by Columbus in 1502, and is said to owe its name (which in Spanish means "depths") to the difficulty he experienced in finding a place where he could anchor. There are numerous pyramids and other traces of the original inhabitants. The people of Honduras rebelled against Spain in 1821, and, after a temporary union with the other countries of Central America, formed themselves into a separate state in 1839. Since that time there have been several wars and revolutions. Honduras is now governed by a President and Congress, elected by popular vote for four years. Religious liberty is guaranteed by the Constitution, but Roman Catholicism is the prevailing religion. Education is free, compulsory from seven to fifteen years of age, and entirely secular. The country is burdened with a heavy debt, mainly owing to the vast sums expended in the construction of an inter-oceanic railway and other public works. Agriculture is followed extensively, and, owing to the wide tracts of good pasture-land, cattle-rearing is a profitable branch of industry. Honduras is exceptionally rich in mineral products: gold, silver, iron, copper, platinum, mercury, antimony, zinc, and tin abound, and opals, emeralds, and other precious stones are found in large quantities; the former especially are famed for their beauty. It is only recently, however, that much has been done to develop the mineral wealth of the country, and this has been mainly due to the efforts of North American and other foreign companies. Most of the trade of Honduras is carried on with the United States, the chief exports being cattle, fruits, cotton, sugar, timber, indiarubber, and indigo.

Hone, WILLIAM (1780-1842), writer and bookseller, was born at Bath, and received from his father a severely religious training. During his residence in London and the neighbourhood, as an attorney's clerk (1790-1800), he abandoned the orthodox principles of his youth for those of the London Corresponding Society. In 1800 he set up as a bookseller in London, but he failed several times, nor did his name become generally known until he started the *Reformer's Register* (1817), a weekly periodical, in which he exhibited his talent for parody and lampoon. At the close of the same year he was prosecuted by the Attorney-General for publishing three political tracts—*The Late John Wilkes's Catechism*, *The Sinecurist's Creed*, and *The Political Litany*, a parody on parts of the Church Service, with illustrations by Cruikshank.

The able manner in which he conducted his defence led to his acquittal on all three counts. In 1819 appeared his *Political House that Jack Built*, but he subsequently abandoned politics for antiquarian research, publishing his *Every Day Book* (1826), *Table Book* (1827-28), and *Year Book* (1839), which abound in curious information. Towards the close of his life he became a pious member of a Dissenting congregation. Throughout his whole life Hone was never free from pecuniary embarrassment.

Honey is the saccharine liquid which is secreted by the honey-bee and certain other insects of the same genus. By these it is obtained from the nectaries of flowers, and deposited in the honey-comb. It varies somewhat in colour, consistency, and flavour, according to the different plants from which the bees obtained the supply. It consists of a mixture of different sugars known as *glucoses* (q.v.), with small quantities of cane sugar and non-saccharine material, while it usually contains water to the extent of about 25 per cent. The purest honey is known as "virgin honey," and is a clear yellowish liquid of density 1.44, which does not alter in the dark but slowly thickens and solidifies if exposed to light. Honey comes into commerce either in the comb, or as run honey, i.e. separated from the wax cells of the comb, either by heat, pressure, or other means. It is frequently adulterated with the mixture of starch and grape sugar, usually obtained from potato starch by the action of dilute acid. It has been known since very early times, and before the introduction of sugar was of much greater importance than at present. It is used in the preparation of sweetmeats, in dietary dainties, and in medicinal preparations, for which latter purposes it is always purified by warming and straining through flannel.

Honey Buzzard (*Pernis apivora*), called also the Bee Kite or Wasp Kite, a European bird, owing its latter names to its habit of taking the larva from the nests of bees and wasps—the first being apparently erroneous and having affinities with both kites and buzzards. The general coloration is brown, and the under surface is sometimes spotted with white. The food consists principally of wasp-grubs, though other larvæ and small animals are eaten. The Crested Honey Buzzard (*P. cristatus*) is a native of India.

Honey-eater, **Honey-sucker**, any bird of the Passerine family Meliphagidae, confined to the Australian region, and characterised by their long, slender, curved bill and extensile tongue, ending in a bundle of filaments. There are twenty-three genera, with nearly two hundred species, living chiefly on nectar and insects. One of the best-known species is the Warty-faced Honey-eater (described by Gould), with brilliant black and yellow plumage. *Prosthemadera novaeseelandiae*, about the size of a blackbird, with black plumage of metallic lustre, is a member of this family. The natives call it Tui, and Europeans the Parson-bird, from a tuft of white feathers on each side of the throat.

Honey-guide (*INDICATOR*), any bird of the genus *Indicator*, constituting the family *Indicatorida*, with affinities to the woodpeckers and barbets.

There are eleven species (some of them parasitic) from the Oriental and Ethiopian regions. They are of sober plumage, feeding on bees and sometimes on small birds. Their popular and generic names are due to the belief that they guide men to the nests of wild bees by a peculiar cry. The evidence for this belief seems conclusive.

Honeysuckle, the name applied in England to the genus *Lonicera*, of which there are three indigenous species. They are shrubs with simple, opposite leaves, a small five-toothed calyx, a mono-symmetric bi-labiate corolla with reflexed lobes, four in the posterior and one forming the anterior lip, five stamens and a baccate fruit. *L. Perfoliatum* is the common Honeysuckle, the Woodbine of Shakespeare, the twisted Eglantine of Milton and Tennyson. Other species are *L. Caprifolium* and *L. Xylosteum*.

Hongkong, an island in the south of China, which became a British possession in 1842, in accordance with the Treaty of Nanking. It is about 90 miles S. by E. of Canton, and has an area of 29 square miles, consisting for the most part of barren and desolate rocks, which rise in a precipitous ridge to a height of 1,800 feet. The direction in which it lies is from N.W. to S.E., and between it and the mainland the Straits of Ly-u-mun expand into a magnificent harbour, extending over ten square miles. Opposite the eastern extremity of the island is the peninsula of Kowloon, the southern portion of which is now included in the colony. Hongkong is the chief mart in the south of China, and one of the most important commercial towns in Eastern Asia. The principal import is opium, the chief exports tea and silk. There is also a considerable trade in cotton, sugar, flour, rice, woollens, earthenware, etc. The manufactures include sugar, rum, ropes, and shipping stores. The mean annual temperature is 75° F., and during the greater part of the year the climate is tolerably healthy. The government is carried on by a governor appointed by the Crown, in conjunction with an Executive and a Legislative Council. The island is one of the stations of His Majesty's fleet. Victoria, the capital, is picturesquely situated on the north side of the island on the hills overlooking the harbour.

Honolulu, the capital of the Hawaii or Sandwich Islands, is situated on the southern coast of the island of Oahu. The convenience of the harbour—a lagoon about a mile in length, enclosed by a coral reef, which lies on one side an opening about 300 feet wide—caused it to be visited in the first instance by whalers, and subsequently by ocean steamers and traders, who here have the opportunity of obtaining water and stores. It has now become a commercial centre of some importance, the trade being mainly carried on by foreigners, especially Americans. The town is situated above the harbour, on a plain formed of coral, at the opening of a valley which descends from the mountains in the interior. It contains some handsome public buildings and many private houses in the European style, interspersed with gardens and orchards. The climate is dry, but very pleasant.

Honorius, FLAVIUS (384-423), succeeded his father Theodosius as Emperor of the West, while the eastern half of the empire fell to the share of his brother Arcadius. The attacks of the northern races were at first warded off by Stilicho (q.v.), but after his murder in 408 Rome was besieged and taken by the Visigoth Alaric (410). During the remainder of the reign there were frequent and manifold signs of the disruption which was soon to culminate in the Ostrogothic conquest.

Honorius I. (d. 638) became Bishop of Rome in 625 in succession to Boniface V. In consequence of his wavering attitude during the Monothelite controversy he was denounced as a heretic at the Council of Constantinople (680).

Honthorst, GERHARD VAN, called "GERARDO DALLE NOTTI" (1590-1656), Dutch painter, born at Utrecht, studied at Rome, where he was much influenced by the paintings of Caravaggio. He came to England in 1620, and again in 1628, and was patronised by Charles I. He excelled in depicting night scenes, generally illuminated by the light of torches or candles.

Hood. The academical hood, originally a variety of the monk's cowl, is worn by members of universities and of colleges which possess the right of conferring degrees. The material and colour of the hood denote the university and degree of the wearer. Hoods are also worn by "literates" or clergy of the Church of England not members of a university, and several Anglican theological colleges have distinctive hoods.

Hood, the surname of a most distinguished family of naval officers, of whom the most celebrated are:—**SIR SAMUEL**, first Viscount Hood, who was born in 1724, and became a commander in 1754, and a captain in 1756. In command of the *Antelope*, 50, in 1757, and in command of the *Vestal* in 1759 he captured the *Bellone*. In April, 1781, he engaged the French off Martinique, in September following he was second in command in the action off the Chesapeake, and in 1782 he repulsed De Grasse at St. Kitts. In 1782 also, as second in command under Rodney, he took part in the total defeat of the French in the West Indies, and was in consequence raised to the Irish peerage. In 1787 he became a vice-admiral, and in 1793 was made commander-in-chief in the Mediterranean, where he took possession of Toulon and the large fleet lying there, reduced Corsica, and performed other great services. He became an admiral in 1794, and died in 1816.

SIR SAMUEL, a cousin of the above, was born in 1762, commanded the *Renard* in the action of April 12th, 1782, and was posted in 1784. He served in the reduction of Corsica, and was with Nelson at Teneriffe and at the Nile. In 1799 he expelled the French from Naples; in 1801 he commanded the *Venerable*, 74, in Sir James Saumarez's actions; and in 1803, as commodore in the West Indies, won a K.B. for the capture of Demerara, Essequibo, and Berbice. In 1807 he took possession of Madeira, and in 1808 he effected the destruction of the Russian *Sovolod*, 74. He died in 1814.

AUTHUR WILLIAM ACLAND, grandson of Captain Alexander Hood, killed in command of the *Mars*, was born in 1824, served in the China War in 1857, was director of naval ordnance in 1869–74, and a Lord of the Admiralty in 1877–79, 1885–86, and 1886–89, and, after having retired as an admiral, was raised to the peerage in 1892 as Lord Hood of Avalon; so that the family possesses the unique honour of having gained three naval peerages.

Hood, THOMAS (1799–1845), poet and humorist, was the son of a London publisher. He was born in the Poultry, and was placed at the age of thirteen in a merchant's counting-house; but his health failing him, he was sent to his father's relations in Dundee, with whom he remained from 1815 to 1818. On his return to London he was apprenticed to his uncle, the engraver Sands, and afterwards to Le Keux, but this profession he was compelled to relinquish through ill-health. In 1821 he became sub-editor of the *London Magazine*, and through it formed the acquaintance of Charles Lamb, De Quincey, Hazlitt, and other eminent men of letters. Another colleague on the *London Magazine* was John Hamilton Reynolds, whose sister he married in 1824, and in conjunction with whom he wrote *Odes and Addresses to Great People* (1825). It was soon followed by the two series of *Whims and Oddities* (1826–27), as well as by *The Plea of the Midsummer Fairies* (1827) and other poems. For one year (1829–30) he edited the *Gem*, in which appeared several noteworthy poems, including some of Tennyson's and his own *Dream of Eugene Aram*. But—partly, perhaps, owing to the stress of poverty—he was induced to cultivate the humorous rather than the poetic side of his genius, and in 1830 he started the *Comic Annual*. Towards the end of 1834 his pecuniary embarrassments, which had become more pressing through the failure of a firm with which he was connected, forced him to remove to the Continent, but not before he had done his utmost to satisfy his creditors. During his stay at Coblenz (1835–37) and Ostend (1837–40) he was engaged, notwithstanding his constant ill-health, in the attempt to repay the money lent him by his publishers by means of his literary productions. To this period belong *Hood's Own* and *Up the Rhine*. Soon after his return to England in 1840 he settled at Finchley, where he remained until his death. From 1841 to 1843 he was editor of the *New Monthly Magazine*, in which appeared the characteristic effusion entitled *Miss Kilmansegg*. His pathetic lyric *The Song of the Shirt* was published in the Christmas number of *Punch* for 1843. In 1844 he started *Hood's Magazine*, but his shattered health broke down completely under the strain of overwork, and before the end of the year he became too weak to leave his bed. He died in the following May. His last days were cheered by the knowledge that a pension recently granted him by Sir Robert Peel would be continued to his widow. The range of Hood's literary gifts was extremely wide. With a fascinating wit and extraordinary skill in playing upon words, he united a rich humour and a rare power of exciting the deeper emotions through his keen sympathy with human frailty and suffering.

The last quality is especially conspicuous in his *Bridge of Sighs* and *Song of the Shirt*. It is perhaps owing to the strong hold his humorous and pathetic writings have taken of the English people that his more purely imaginative work—such as his poem of *Hero and Leander*—is now so little remembered.

Hooghly. 1. The most westerly of the branches into which the Ganges divides itself as it approaches its mouth, is formed by the union of the Bhagrattee and the Jellinghee. Reckoning from a point 64 miles above Calcutta, it has a course of about 145 miles to the Bay of Bengal. It often becomes silted up, and much loss is sometimes caused by the moving banks and quicksands. The bore is said sometimes to reach the height of 15 feet. 2. A town on the river Hooghly, 27 miles north of Calcutta. It has a college for the study of English and Asiatic literature.

Hook, THEODORE EDWARD (1788–1841), wit and novelist, was the son of James Hook, a musical composer. He was born in London, and educated at Harrow and Oxford. His *Soldier's Return*, a comic opera, acted when he was only sixteen, was followed by numerous melodramas and farces, which appeared in quick succession. At the same time he became a general favourite in London society owing to his wit and gaiety and his power of repartee and of improvisation in verse and music. In 1813 he was appointed accountant-general and treasurer of the Mauritius, but in consequence of the discovery of a deficiency of 62,000 dollars he was summoned home in 1818. As he was unable to give any account of the money, he was held responsible for its loss, and was imprisoned in the King's Bench from 1823 to 1825. In 1820 he became editor of *John Bull*, a Tory journal, which he conducted with much skill, though not always with very good taste. His novels—*Sayings and Doings* (a series of nine published in 1826–29), *Maxwell* (1830), *Gilbert Gurney* (1836), etc.—were all of them realistic representations of actual characters and events. He also wrote a *Life of Sir David Baird* (1832), and recast the *Memoirs of Michael Kelly*.

Hook, WALTER FARQUHAR (1798–1875), the nephew of Theodore Hook, was educated at Winchester and Oxford. He was vicar of Leeds from 1837 to 1859, when he became Dean of Chichester. Dean Hook belonged to the High Church party, and gave his support to the earlier numbers of the *Tracts for the Times*, but abandoned the movement when it seemed to him to show a Romanising tendency. He wrote *Lives of the Archbishops of Canterbury* (1860–76), a *Church Dictionary* (1842), etc.

Hookah, a kind of tobacco-pipe, used in Arabia, Turkey, India, and other Eastern countries, in which a water-bottle is introduced at the lower extremity of a long flexible stem, between it and the bowl. The smoke is cooled by passing through the water. Hookahs are often elaborately decorated.

Hooke, ROBERT (1635–1703), natural philosopher, was born at Freshwater in the Isle of Wight, and received his education at Westminster and Cambridge. He was appointed curator of experiments to the Royal Society in 1662, and

professor of geometry in Gresham College in 1665, and acted as secretary to the Royal Society from 1677 to 1682. Hooke possessed extraordinary mechanical skill, and was remarkably quick in discerning general principles, even when aided by very slender evidence. He to some extent anticipated Newton's theory of gravitation and other discoveries in natural philosophy, and made improvements in the microscope, telescope, and quadrant. His chief work was his *Micrographia* (1665).

Hooker, JOSEPH (1814-79), an American general, born in Massachusetts, was educated at West Point, and served with distinction in the Mexican War. After living for eight years in retirement he joined the Northern army in 1861, and was placed in command of a body of volunteers. In the Peninsular campaign he displayed conspicuous courage, earning for himself the title of "Fighting Joe." In January, 1863, he was appointed commander of the army of the Potomac; but, over-estimating the forces at his command, he made a rash attack on the Confederate troops under Lee and Jackson, and was defeated in two engagements near Chancellorsville (May 2-3). In consequence of his ill-success he was deprived of his command, but he distinguished himself on several subsequent occasions, and in 1865 was promoted to the rank of major-general. He retired from the army in 1868.

Hooker, RICHARD (1554-1600), author of the *Ecclesiastical Polity* ("the judicious Hooker"), was born in 1554. Bishop Jewel furnished him with the means of proceeding from Exeter grammar school to Oxford, where he entered Corpus Christi College in 1568. After Jewel's death in 1571 Hooker found a new patron in Edwin Sandys, Bishop of London, afterwards Archbishop of York, who placed his son under his charge. This youth and another pupil, George Cranmer, great-nephew of Archbishop Cranmer, always remained Hooker's chief friends. In 1581, soon after taking orders, he was appointed to preach the sermon at St. Paul's Cross. Whilst in London he lodged with a Mrs. Churchman, wife of a linendraper, who seems to have inveigled him into a marriage with her unprepossessing daughter. After holding for a short time the living of Drayton-Beauchamp in Buckinghamshire, Hooker was, through Whitgift's influence, appointed Master of the Temple in 1585 in preference to the under-reader Walter Travers. Travers, who was an extreme Calvinist, thought it incumbent on him to impugn the new Master's views in his own discourses, and a keen controversy ensued between them. This dispute led Hooker to inquire more carefully into the principles of Church government, and the result was his famous work, *The Laws of Ecclesiastical Polity*. In order to afford him more leisure for pursuing his studies he was, in 1591, appointed to the living of Boscombe in Wiltshire, whence he removed to Bishopsbourne, near Canterbury, in 1595. Here he died, and his body rests in the parish church. The general aim of the *Ecclesiastical Polity* is to furnish a philosophical basis for the Elizabethan system of Church government. Hence the author is led to inquire into the

nature of law in general, and to examine the sources from which it derives its binding force. This he does in a manner which is alike remarkable for the dignity and eloquence of the language, the severe precision of the argument, and the profound knowledge and philosophical insight which the writer displays. The best edition of the work is that of Keble (revised edition, 1888). Hooker's simple life and modest character are charmingly described in the biography of Izaak Walton, first published in 1665.

Hooker, SIR WILLIAM JACKSON, F.R.S., LL.D. (1785-1865), botanist, was born at Norwich. In early life he made scientific expeditions to Iceland (1809), and to France, Switzerland, and Northern Italy (1814). In 1815 he settled at Halesworth in Suffolk, whence he removed in 1820 to Glasgow as Regius Professor of Botany in the university. In 1841 he was appointed Director of the Royal Gardens, Kew, and during his tenure of the office converted them into a botanical establishment which has no rival in the world. His published works, which were very numerous, include *British Juncaginaceæ* (1816), *Exotic Flora* (1823-7), and *British Flora* (1830-42). His son, **SIR JOSEPH DALTON HOOKER** (b. 1817), was born at Halesworth and educated at Glasgow. He took part in the scientific expedition of Sir James Clark Ross (1839-42), and by his observations on the flora of the Auckland Islands, New Zealand, and Tasmania, afterwards published in *Flora Antarctica*, added greatly to the knowledge of the distribution of plants. A popular account of his travels in India (1848-51) is given in his *Himalayan Journals* (1854), while *Flora Indica* and other botanical works record their scientific results. In 1855 he became assistant director of Kew Gardens, and held the office of director from 1865 to 1885. During these years he carried on the work which his father had begun, and under his management the gardens have been very greatly improved. As President of the British Association in 1868 he supported the views of Darwin regarding evolution. In 1871 he visited Morocco, and ascended the Great Atlas. He was President of the British Association from 1873 to 1878. His chief work was his *Genera Plantarum* (1862-76), written in conjunction with Mr. George Bentham.

Hooke's Law is that for any elastic substance that is stretched or compressed under the action of some external force, the *strain* or proportional extension or compression produced is a constant sub-multiple of the *stress* or intensity of the force producing deformation. The law only holds within the elastic limit; if the load is too great, a *permanent set* is the result, the stress is not proportional to the strain, and the substance when relieved of the stress will not return to its original dimensions. If a rod of sectional area a and length l be extended by an amount λ on the application of a total load W , then the stress or load-intensity is $\frac{W}{a}$, the strain is $\frac{\lambda}{l}$, and Hooke's

law states that within the elastic limit $\frac{W}{a} = k \frac{\lambda}{l}$

where k is a constant for each elastic material employed. It is, for example, about 29,000,000 lbs. per square inch for wrought-iron. This quantity k is known as the modulus of elasticity of the material. [MODULUS, ELASTICITY.]

Hooper, JOHN (d. 1555), English martyr, was born in Somersetshire. After leaving Oxford he entered a Cistercian monastery at Gloucester, and on the dissolution proceeded to London, where he became influenced by the writings of Zwingli and Bullinger. The Protestant views he now formed compelled him to flee to France in 1539, and, with but a slight interval, he remained abroad for the next ten years, residing at Zürich from 1547 to 1549. After his return to England he became a prominent leader of the advanced Protestant section, and was appointed Bishop of Gloucester in 1550 and of Worcester in 1552. On the accession of Mary he was sent to the Fleet, and after eighteen months' imprisonment tried and convicted of heresy. He was burnt at Gloucester, February 9, 1555.

Hoopoe, any bird of the genus *Upupa*, with six species, constituting the family *Upupidae*. They are semi-terrestrial birds allied to the Hornbills in structure, feeding on insects, and most abundant in the Ethiopian region, though they extend into Europe and Asia. *U. epops*, the common Hoopoe, was formerly British, but is now only a visitor. The male is about a foot long, with finely variegated plumage of white, buff, and black, with a very large erectile crest. The colours of the female are a little less intense than of her mate. The cry of the bird (*hoo-hoo-hoo*) seems to have given it its name in most languages.

Hop (*Humulus lupulus*), the only representative of a genus belonging to the Cannabinaceæ, the same group as the hemp, is a herbaceous perennial, producing annually several twining shoots, often 15 or 20 feet long. It twines contrarily to the hands of a clock, has a very rough surface, and bears opposite, stalked, 3- to 5-lobed, coarsely serrate leaves, resembling those of the vine, but with a rough surface. The male ("seeders") and female flowers are on distinct plants, but the latter only are cultivated. The female inflorescence is a catkin or *strobilus*, with large bracts, each having in its axil two flowers each with a bracteole. The ovary and base of the bracts are covered with a yellow powder consisting of minute glands containing wax and the bitter acid principle lupulin ($C_{33}H_{50}O_7$), to which hops owe their value. In brewing, hops clarify the beer, give it an agreeable bitter flavour, and render it capable of being kept by checking the acetous fermentation. Hops were first systematically grown for market in England in the 16th century. They are cultivated chiefly in Kent, Sussex, and Herefordshire.

Hope, SIR JAMES, naval officer, was born in 1808, and became a captain in 1830. He commanded the *Firebrand* in the expedition to the River Plate in 1844-45, and behaved with conspicuous gallantry at the battle of Obligado. During the Russian War he commanded the *Majestic*. He was made a rear-admiral in 1857, commanded in

China during the war in 1859-62, obtained a K.C.B. for the capture of Pekin, and subsequently commanded-in-chief in the West Indies and at Portsmouth. He died an Admiral of the Fleet and G.C.B. in 1881.

Hope, THOMAS (1770 ?-1831), a celebrated traveller and virtuoso, author of *Household Furniture* (1805) and other works of the same kind. His chief contribution to literature, however, was a romance entitled *Anastasius: or, Memoirs of a Modern Greek* (1819), which at the time of its appearance was supposed to be the work of Lord Byron. His son, ALEXANDER JAMES BERESFORD HOPE (1820-87), a zealous defender of Church institutions and chief founder of St. Augustine's Missionary College, Canterbury, was Conservative member for Cambridge University from 1868 to 1887.

Hope's Apparatus is an instrument for showing the temperature of greatest density of water. It consists simply of a cylinder of water around the middle of which there is a belt-shaped hollow for the reception of a mixture of snow and salt. This mixture produces an intense cold, and so causes a lowering of temperature of the middle zones of the water in the cylinder. Inserted in the top and bottom of the cylinder are thermometers recording the varying values of top and bottom temperatures. The middle regions cooling, the water there becomes denser and sinks; we thus see the lower thermometer falling. This goes on till 4° C. is there reached, after which further cooling diminishes the density of the water and it rises. The result is that the upper thermometer falls to 4° C. and then lower till freezing-point is reached, the lower thermometer remaining at 4° C. till nearly all the water in the cylinder is frozen. [HEAT.]

Hopkins, JOHNS (1795-1873), a native of Maryland, United States, after making a fortune as a grocer, founded the Johns Hopkins University in Baltimore in 1873. Unlike most other American universities, this institution has devoted itself specially to forwarding original research and training investigators.

Hopkins, SAMUEL (1721-1803), American theologian, was born at Waterbury, Connecticut, and educated at Yale College. From 1743 to 1769 he was pastor of Housatonic in Massachusetts. The views expressed in his *System of Doctrines* (1793) differ in some respects from the ordinary Calvinistic theology, and have given rise to the growth of a separate school, who do not, however, form a distinct sect. He also wrote a life of Jonathan Edwards.

Hoploparia, a genus of lobsters (Macrura) common in the Chalk and Lower Greensand. Some of the species were very large.

Hoplophoridae. [GLYPTODON.]

Hopson, or HOPSONN, SIR THOMAS, English seaman, born in 1642 at Bonchurch, Isle of Wight, ran away to sea at an early age, and by 1672 found himself second lieutenant of the *Dreadnought*. He was made a captain in 1678, served in the *York* at the battle of Beachy Head, and soon afterwards

was appointed rear-admiral. With his flag in the *Breda* he was second in command of Sir George Rooke's unfortunate convoy to the Straits. He subsequently, as vice-admiral, commanded at the blockade of Dunkirk, and, in the second post, in Rooke's expedition to Cadiz and Vigo. At Vigo, in the *Torbay*, he led the van with great gallantry, and broke the boom under a frightful fire. His ship was so severely mauled that he had to transfer his flag to the *Monmouth*. He died in 1717. It is said that Hopson, when a boy, climbed from the mainyard of his own ship to the main-topgallant mast-head of an enemy's ship that was in action alongside, and hauled down her colours.

Horace (QUINTUS HORATIUS FLACCUS) (65-8 b.c.), Roman poet, was born near Venusia in the south of Italy, on December 8th, 65 b.c. From his father—a manumitted slave, who had been a tax-collector or an auctioneer and had devoted his savings to the purchase of a small estate—he received a better education than usually fell to the lot of members of his class. His studies at Rome were continued up to his eighteenth or nineteenth year. He then went to Athens to receive instruction in the higher branches of philosophy and rhetoric. Whilst at Athens, in the latter part of 44 b.c., he joined the army of Brutus, who was proprietor of Macedonia and had come to the city for the purpose of raising troops. He held a high command in the republican army at Philippi, and after that disastrous battle effected his return to Italy, where he escaped proscription at the hands of the Triumvirate, but was deprived of his property. A small post in the service of the State hardly gave him enough to live on, and he turned to literature as a means of increasing his income. His earlier productions were mostly satires, some directed against the vices of society, others against the foibles of individuals, and it was not till he began to write lyrics that the higher qualities of his genius became manifest. He now became the friend of Virgil, by whom he was introduced to his patron, the minister Mæcenas (about 38 b.c.). Mæcenas' gift of a farm amidst the Sabine hills placed him beyond the fear of want, and he was able to give himself up to a life of easy conviviality, alternating with rural pursuits, which was thoroughly in accordance with his tastes. By Mæcenas he was brought to the notice of Augustus, who is said to have offered him a position in the royal household, which he declined. As the author of the *Carmen Seculare*, written for the celebration of the Secular Games in 17 b.c., he occupied a public position of a more secure and honourable kind. His death took place on November 27 in the year 8 b.c.

The works of Horace, with the dates assigned to them by the best authorities, are—two books of *Satires*, of which the first appeared in 35, the second in 30 b.c.; the collection of lyrics called *Epodes* (about 30 b.c.); four books of *Odes*, of which the first three were published in 19 b.c.; the earlier *Epistles*, written about the same time; the *Carmen Seculare*, and the later *Epistles*, including the fragment of literary criticism entitled *Ars Poetica*.

The qualities which entitle Horace to rank among the poets of all time are his wide knowledge of men and things, his sympathy with the light and shades of life and character, and his exquisite literary skill. His artistic gifts are especially conspicuous in his *Odes*—a form of composition which he carried to the highest state of perfection—while his *Epistles* owe their charm to their worldly wisdom, their genial humour, and their easy but refined familiarity. Horace was an adherent of the Epicurean school of philosophy—he calls himself “a pig of the herd of Epicurus”—which taught that life is short and that men should make the most of it while they can. But this end is to be realised not by giving way to the violence of the passions, but by cultivating every innocent enjoyment, and thus producing a calm and happy temper of mind. Although the gaiety and carelessness which mark Horace's poetry may at first sight seem somewhat superficial, he by no means disregards the deep problems of life and destiny. Occasionally he shows a flash of insight into the deeper springs of feeling, and through the whole of his poetry there runs a note of regret for the shortness of life and the vanity of all human effort.

Horatii and Curiatii. According to an ancient Roman legend, the rival claims of Rome and Alba Longa, in the reign of Tullus Hostilius (q.v.), were settled by a combat between three brothers on each side, the Horatii representing Rome and the Curiatii Alba. After two of the Horatii had been slain, the survivor vanquished each of his antagonists in turn, and thus decided the contest in favour of Rome. As he was entering Rome on his return he encountered his sister, who was attached to one of the Curiatii, and reproached him bitterly with his death. Horatius was so enraged that he immediately stabbed his sister, and for this crime he was condemned to death by the *duumviri*. But the populace rescued him, and he afterwards became the conqueror of Alba Longa. He was said to have been the ancestor of the Horatius Cocles who defended the bridge at Rome during the attack of the Tuscan king, Lars Porsena.

Horehound, a name applied to several members of the order *Labiatae*, especially *Marrubium vulgare*, the common or white horehound, and *Baliora nigra*, the black horehound. The former has a rhizome, and bears a branched shoot a foot high covered with a white, hoary felt of hair. The flowers are small, in dense sessile clusters, and whitish, with a 10-toothed calyx, flat bi-lobed upper lip to the corolla, and tri-lobed lower lip and short included stamens. The plant has an aromatic odour and a bitter taste, and has long been in popular use for the treatment of coughs.

Horizon. There are two distinct meanings to the term. The first is the visible horizon, and may be defined as the line where earth and sky meet. This is irregular on land, and may be broken up considerably by hills, etc. On the open sea the visible horizon is a circle, depending in magnitude on the height of the observer, and depressed below him by an amount also depending on his elevation. This depression is called the *dip* of the visible

horizon. The astronomical horizon signifies the great circle of the celestial sphere whose plane is at right angles to the line joining the zenith to the observer.

HORizon, ARTIFICIAL, is a basin of mercury protected so that its surface shall remain clean and unruffled. Celestial objects reflected from the surface of the mercury appear to the eye as though they were at as great a distance below the horizon as they are actually above it. On account of this fact, a knowledge of the actual position of the horizon may be dispensed with—a matter of much convenience on land.

Horn, a brass musical instrument resembling the trumpet. The "French" or hunting horn, out of which has grown the modern orchestral horn, consisted of a long slender tube gracefully curved in several concentric circles and terminating in a bell. The horn has a compass of about four octaves. Its open tones are harmonics of the natural tone of the tube. Since it has been used in orchestral music a method has been devised of varying its pitch by means of detachable crooks of different lengths, which are added to the tube so as to increase the length of the latter. The pitch can be further modified by means of the "tuning-crooks" or "tuning-slide." The old method of producing close tones by placing the hand inside the bell was invented by Hampl of Dresden in 1770. Ventils or valves are now generally used for the rendering of rapid passages. The English hunting horn and the older post-horn are both valveless instruments more properly of the character of a bugle.

Horn, a general name for the weapons on the heads of ruminants and rhinoceroses, and for the analogous structures in beetles. Thus used, it includes antlers (q.v.), but, properly speaking, the name is confined to the head-growths in the Cavigornia (oxen, sheep, and antelopes) and rhinoceroses. It is also employed to designate the epidermic tissue of which these structures are composed. Horns in the Cavigornia are borne on bony outgrowths (horn-cores) from the frontal bone and, except in the prong-horn (q.v.), are unbranched and persistent. The Chikara (q.v.) alone of living species has two pairs of horns. Unlike antlers, true horns are generally present in both sexes. The "horn" of the rhinoceros, which is supported on the nasal bones—the second horn, when present being on the frontal—is really a gigantic wart, composed of horny fibres growing from papillæ on the skin and cemented together by cells that grow up from between these papillæ. It takes a fine polish, and is fashioned into drinking cups, handles for tools, etc. Thin plates of horn were used in windows before glass was common, and down to recent times for lanterns, as less liable to breakage.

Horn, CAPE, a precipitous, bare, and jagged headland on Hermit Island, in the Fuegian Archipelago, is the most southerly point of America. It was called "Hoorn" by the discoverer, Schouten (1616), a native of the town of that name in Holland.

Hornbeam, *CARPINUS*, a small genus of deciduous trees belonging to the order Corylaceæ.

C. betulus, the common hornbeam, our only native species, has smooth light grey bark, which with its foliage resembles those of the beech; but the leaves are pointed and duller. Its timber is dense, white, and tough, giving its name to the tree. It is used for wooden mill-cogs, and furnishes excellent fuel and gunpowder charcoal. American species, *C. americana*, is known as iron-wood, blue beech, or water beech.

Hornbill, any bird of the Picarian family Bucerotidæ, with twelve genera, containing fifty species, from the Oriental, Ethiopian, and Australian regions. They are for the most part large birds, with enormous bills, and in some cases crests or helmets, with some outward resemblance to, but no close relationship with, the Toucans of the New World. They are chiefly fruit-eaters. The male plasters up his mate in her nest, feeding her and her young till nearly full grown, through a small slit left for the purpose.

Hornblende, or AMPHIBOLE, a group of mineral silicates of magnesium and calcium, the former predominating, with occasionally iron, aluminium, sodium, or other metals. *Hornblende*, the black aluminous variety, occurs in syenite, syenitic granite, diorite, and some andesites and trachytes. *Actinolite*, a bright green form, occurs in needles, fibres, and narrow crystals in hornblende-schists and amphibolites. *Nephrite*, another green form, forms the hard tough substance known as *jade* (q.v.). *Asbestos* (q.v.) is a fibrous white variety.

Horn-book, a leaf of vellum, formerly used in teaching children to read and count. The leaf was covered with a sheet of transparent horn, and enclosed in a wooden frame with a handle for the child to grasp. On the vellum were written the alphabet, the Roman numerals, the Lord's Prayer, and sometimes a few short words. At a later date the leaves were made of paper and printed, and in this form they remained in use till the middle of the 18th century.

Hornby, SIR PHIPPS, naval officer, born in 1785, served with Nelson and on shore at the defence of Gaeta, and was made a commander in 1806 and a captain in 1810. He greatly distinguished himself in the defence of Sicily, and more especially in Hoste's victory off Lissa, in which he was wounded. After attaining flag-rank in 1846, he was controller-general of the Coastguard and commander-in-chief in the Pacific, with his flag in the *Asia*. He died an admiral in 1867. His son, SIR GEOFFREY THOMAS PHIPPS HORNBY, born in 1825, became a captain in 1852, and attained flag-rank in 1869. He early gained extraordinary reputation as a tactician, and, after holding minor commands, was commander-in-chief in the Mediterranean, a lord of the Admiralty, commander-in-chief at Portsmouth 1882-85, and commander of the Particular Service Squadron 1885.

Horne, RICHARD HENRY (1803-84), poet and dramatist, was born in London. After serving in the Mexican navy in the war against Spain, he settled in London as a literary man, and in 1828

contributed to the *Athenaeum* a poem called *Hecatompyle*. His epic *Orion* (1843) was published at the price of one farthing. In 1844 appeared *A New Spirit of the Age*, a volume of critical essays written in conjunction with Mrs. Browning and Robert Bell. The years 1852-69 were passed in Australia, where he held numerous posts, chiefly in connection with the gold-fields. Horne's literary merits, which are incontestable, have never been recognised by the general public. Even *Orion* is little read, and his numerous other works are almost completely forgotten.

Horned Screamer. [SCREAMER.]

Horned Toad, Frog, or Lizard (*Phrynosoma cornutum*), a South American Agamid lizard. The head is toad-like and spinous.

Horned Viper. [CERASTES.]

Horner, FRANCIS (1778-1817), political economist, was born and educated in Edinburgh. He came to London in 1802, and in 1806 entered Parliament as a Whig. It was mainly through his efforts as chairman of the Bullion Committee of 1810 that payment in cash was resumed and the evils of an inconvertible paper currency checked.

Hornet, a large wasp (q.v.) which may be distinguished from the smaller British species by its reddish colour and a series of red spots along each side of the abdomen. It lives in small communities in the south of England and on the Continent. It usually builds its nest in trees or in thatched roofs.

Horny Sponges, or KERATOSA, the division of sponges including the common sponges of commerce. They belong to the division *Noncalcarea*, from which they differ in the absence of spicules and the presence of numerous fibres of "spongin" or "keratose" which compose the sponge. [SPONGE.]

Horology. [CLOCKS, WATCHMAKING.]

Horrocks, JEREMIAH (1617?-1641), astronomer, was born at Toxteth Park, near Liverpool, and educated at Cambridge. In 1639 he accepted the curacy of Hoole, Lancashire, where he made his famous observation of the transit of Venus across the sun, recorded in *Venus in Sole Visa*, which was published by Hevelius at Danzig in 1662. His theory of lunar motion is commended by Newton. His early death was a great loss to science.

Horse, a book-name for any species or individual of the family Equidae, belonging to the Perissodactyle (or odd-toed) Ungulates, and equivalent to the lapsed order Solidungula or Solipedia (a name which in a slightly different form goes back to the days of Pliny). All the living and the later fossil forms are characterised by the possession of a single perfect digit, enclosed in a broad hoof, on each limb. Modern systematists recognise but a single genus *Equus*, but Gray founded his genus *Asinus* for the Asses, while Smith placed the Zebras and the Quagga in a third, *Hippotigris*, the name by which the striped forms were known to the Romans.

There are generally said to be twelve species of

the genus *Equus*. These may be conveniently distributed into two groups, the latter of which is again divided.

A. THE CABALLINE GROUP :—TRUE HORSES.

1. *E. caballus* (the Domestic Horse).
2. ? *E. przewalskii* (Prejevalsky's Horse).

B. THE ASINING GROUP.

(a) Of Uniform Coloration.—True Asses.

3. *E. asinus* (the Domestic Ass).
4. *E. hemionus* (the Kiang or Dziggetai).
5. *E. onager* (the Onager).
6. *E. hemippus* (the Syrian Wild Ass).
7. *E. tarpanops* (the African Wild Ass).

(b) Striped :—Zebras.

8. *E. zebra* (the Zebra).
9. *E. burchelli* (the Dauw, or Burchell's Zebra).
10. *E. chapmani* (Chapman's Zebra).
11. *E. grevyi* (Grevy's Zebra).
12. *E. quagga* (the Quagga, ? extinct).

It is, however, certain that all are not entitled to specific rank. Leaving No. 2 for the present, there



SKELETON OF MAN AND HORSE.

A. Knee (stifle of horse). B. Ankle-joint (hock). C. Elbow-joint. D. Wrist (knee of horse). E. Humerus, bone of upper arm. F. Femur, or thigh-bone.

are grounds for believing that No. 3 and No. 7 are very closely allied, if not identical, and that No. 5 and No. 6 are but sub-species or varieties of No. 4. No. 10 is a sub-species of No. 9, so that, according to Sir William Flower, "there are at least seven modifications of the horse-type, at present, or very recently existing, sufficiently distinct to be reckoned as species by all zoologists, and easily recognised by their external characters." [Ass, QUAGGA, ZEBRA.]

The horse (*E. caballus*) is distinguished from all other members of the genus by its flowing mane and tail, the latter covered with hair from the root, arched neck, well-formed head, large rounded hoofs, and a wart or callosity on the inner side of each hind limb, just below the ankle joint (the hock), in addition to that on the inner side of each fore limb, just above the carpal joint (the so-called

"knee"), common to all the genus. These "chestnuts" or "mallenders" are normal growths, existing in both sexes at birth, but their origin and function are unknown. The dental formula is $I \frac{1}{1} C + PM \frac{1}{1} M \frac{3}{3} = 44$. The first premolar is rudimentary, and the canines or "tushes" are generally present only in the males. The incisors are disposed in a semicircle. In the crown is a pit surrounded by a ring of enamel, which with the outer layer forms the "mark" by which the age of a horse is ascertained. When by use the tooth is worn away below the pit the inner ring disappears, and the horse is said "to be out of mark or 'past mark of mouth.'" This takes place in the eighth or ninth year. The incisors are separated by a short interval from the canines, and these from the premolars by a greater, technically known as the diastema, and popularly as the "bar," of great importance as affording space for the bit, by which the animal is governed. The grinding teeth are marked by complex crescentic folds of enamel, and the outer spaces are filled with a thick coating of cement. The orbit is surrounded by a bony ring, and the upper lip is prehensile. The hoof with its enclosed bone corresponds to the last phalanx or joint of the third digit with its nail in man, and the plantar cushion or under part of the hoof to the soft padlike end of the digit. The metacarpal and metatarsal bones of the last second and fourth digits are present in the form of splints.

The horse figures on Egyptian monuments both as drawing chariots and carrying armed men, and from Scripture it is clear that the Hebrews derived their horses from Egypt. Of the classic passage in Job (xxxix. 19-25), Borrow says—"Who has ever seen a blood stallion excited by the din of a fair or a battle and heard him to distinctly neigh ha! ha! can doubt that the author of Job painted an Oriental war-horse from life?" The presence of the wild horse in Europe goes back to Neolithic times, when it was a beast of chase. In the Bronze Age, however, horses were employed for riding, as is shown by the bronze bits discovered in France and Italy. The ancient Greeks at first used the horse to draw chariots, and it was not till about 500 B.C. that they employed it as a beast of burden. Cavalry played an important part in the early Roman wars, and under the later kings the horse was utilised for burden and draught. Virgil in his *Third Georgic* gives rules for breeding and training, some of which, as to kind treatment, might be advantageously impressed on horse-breakers of our own day. The Britons had cavalry and war-chariots when Caesar landed (*de Bell. Gall.* iv. 26). In the reign of Athelstan horses were imported from Germany and Spain to improve the native breed. After the Conquest, William I. paid great attention to the native horses, and John imported Flanders stallions, to which the strength and stamina of English horses is in great measure due. During the Crusades there must have been a considerable infusion of Arab blood, and from Edward III. English sovereigns did much to improve the native breed by crossing English horses with those imported from Spain, the descendants of Arabs introduced into the Peninsula by the Moors.

King James I. paid £154 for a small bay Arab horse—the Markham Arab, with £11 "to the man that brought him," and from that time Arab blood was mixed with that of the English strain (Godolphin Arab and Byerley Turk are the most famous), and the pedigree of "Derby and St. Leger winners may invariably be traced to one of the Oriental sires of the seventeenth century recorded by Mr. Weatherby" in the fourth edition of his *Stud Book*.

The racehorse generally stands from 15½ to 16 hands high. (The hand equals 4 inches, and measurements are taken at the withers.) The colour is usually some shade of chestnut or bay, rarely black or roan, and scarcely ever grey. The more length and size there is, on short legs, the better, with a well-shaped head, full nostrils, with a strong deep neck running imperceptibly into the shoulders. The hips should be deep and round, with little space between them and the back ribs. This will give freedom of action, propelling power, and fine stride.

Racehorses that do badly in training are often sold for *hunters* and *steeplechasers*, though generally these horses are not thoroughbred. "In the gallop the steeplechaser should be a dashing, savage goer, bending his knees well. The racehorse should glide along with a straight reach, as smoothly as a cutter through water." The withers should be high, and the shoulders long, that the horse may rise well at his fences, and the hip and pelvis broad, with light back ribs and a loose flank that he may dash his haunches under him at a big jump.

A charger should be stout, well-built, and 16½ or 16 hands high, for a cavalryman with his accoutrements rides from 18 to 22 stones. The military seat differs from that of the hunting man in that the soldier rides with longer stirrups, and the recruit in the riding school is taught to maintain his position by grip, and to govern his horse chiefly by pressure of the legs.

Carriage and coach horses for state functions and the Park may be as much as 17 hands high, and are either thoroughbred or have a large infusion of blood. Animals of this character fetch a high price, especially when matched in teams or pairs. For ordinary carriage work about 15 hands is the usual height.

The cart-horse is a distinct breed, adapted for drawing heavy weights at a walk. It was introduced by the Dutchmen who followed William III. to England, and set to work to drain the Fens. In the early part of the 19th century there were some half-dozen different breeds, but the old Cleveland Bay is now nearly if not quite extinct, and the Clydesdales and the Suffolks are in the highest repute. The largest cart-horses are those used by brewers and railway companies.

A pony is a horse that does not reach 13 hands, though the term is often loosely applied to any small horse. The chief British breeds are those of Shetland and Exmoor and Dartmoor, some specimens of which do not exceed 9 hands. Large numbers of Welsh ponies are used, and the New Forest ponies are locally known as heath-croppers.

The senses of the horse are very acute, and its intelligence great. Its skin is highly sensitive,

and it has what in men is called the nervous temperament. It is also capable of a high degree of training, and seems to enjoy the performance of complicated evolutions, as may be seen in the musical rides at the Military Tournament held in London every year.

The utility of the horse to man can scarcely be overrated. Not only is it a valuable servant while living, when dead its hide furnishes leather, the bones are ground for manure, the intestines are made into catgut, glue is manufactured from the hoofs, and the hair of the mane and tail is woven into haircloth or used for stuffing mattresses, etc. In France horseflesh is largely eaten, and it is said that much of it is sold in Paris for beef. If exposed for sale in England, the fact must be notified on the shop or stall in letters not less than four inches long.

The entire horse is called a *stallion*, and the female a *mare*; the young is a *foal*, if a male a *colt*, if a female a *filly*. The mare breeds at three years old, is served by the stallion in the early summer, and carries her single foal eleven months.

According to Darwin, the horse is probably descended from "a single dun-coloured, more or less striped, primitive stock, to which our horses still occasionally revert," and "aboriginally must have inhabited countries annually covered with snow, for he long retains the instinct of scraping away to get at the herbage beneath." But this "primitive stock" has long ago disappeared, and the herds of so-called "wild horses" of Tartary known as Tarpans, in America as Cimarrones or Mustangs, are certainly feral, that is, the descendants of animals escaped from domestication.

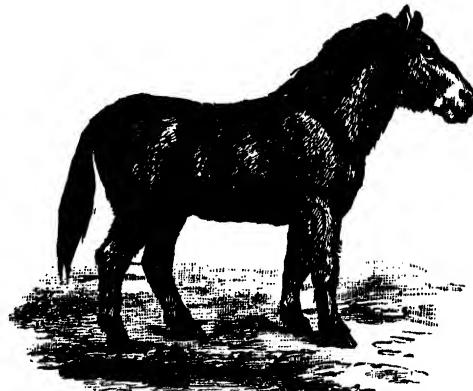
Whether Prejevalsky's Horse (*E. przewalskii*) is a good species is an open question. See Grijimailo in the *Proceedings of the Royal Geographical Society* (April, 1891).

Sir William Flower (*The Horse*, p. 79) thus summarises the description of the animal by Poliakov, who established the species:—

"It has callosities on all four limbs, as in the horse, but only the lower half of the tail is covered with long hairs, as in the ass. The general colour is dun, with a yellowish tinge on the back, becoming lighter towards the flanks, and almost white under the belly, and there is no dark dorsal stripe. The mane is dark brown, short, and erect, and there is no forelock. The hair is long and wavy on the head, cheeks, and jaws. The skull and the hoofs are described as being more like those of the horse than the ass. Until" (he adds) "more specimens are obtained, it is difficult to form a definite opinion as to the validity of this species, or to resist the suspicion that it may not be an accidental hybrid between the kiang (*E. hemionus*) and the horse." However, J. A. Thomson (*Outlines of Zoology*, p. 581) accepts it as a valid species.

The horse in its modern form dates back to Pleistocene times, but its evolution may be traced to a more remote period, through Pliocene forms in which the second and fourth digits of the fore limb were more or less rudimentary, and the Miocene *Miohippus* or *Anchitherium* and *Mesohippus* with three digits, or three and a rudiment, to

Hyracotherium, with four functional digits, and back to *Phenacodus* with five digits on each foot. This animal, from the Wasatch Eocene of N. America, stands in the direct line of the ancestry of Artiodactyle as well of Perissodactyle Ungulates. (Nicholson



PREJEVALSKY'S HORSE.

and Lydekker: *Paleontology*.) With regard to the "home" of the horse, Lydekker thinks that, as a series of identical or closely-allied forms are found in the Tertiaries of Europe and America, a parallel development has simultaneously taken place, and he supports his opinion by the fact that the Indian living dogs are derived from the Pliocene form of the same region, and Brazilian dogs from dogs of the Cave epoch of South America. Professor Cope believes that *Protocippus* in the West and *Hippion* in the East was the immediate ancestor of the genus *Equus*.

Horse, MASTER OF THE, an officer in the royal household, whose duty it is to superintend the King's stables and horses. The appointment becomes vacant with every change of Government.

Horse-chestnut, the popular name of a genus of trees belonging to the order *Sapindaceæ*, probably derived from the resemblance of their seeds to the fruits of the true or sweet chestnut, a totally distinct tree, whilst this is inedible—"horse" being a contemptuous prefix signifying "coarse," as in horse-radish, or as the "dog" in "dog-violet." They have smooth bark; opposite, exstipulate, palmate leaves of 5 to 9 leaflets; a five-lobed calyx; 4 to 5 petals; 5 to 8 stamens; and a three-chambered single-styled ovary, which forms a leathery hispid capsule containing several large exaluminous seeds. The common horse-chestnut, *Aesculus Hippocastaneum*, is not certainly known in a wild state. It grows 50 or 60 feet high, with branches which ascend and then curve downwards and outwards, and very large buds, which are very glutinous in spring. There are typically 7 obovate-cuneate leaflets, which are somewhat exceptional in hanging downwards in the bud and rising as they expand. The inflorescence is a conspicuous pyramidal raceme of cymes, terminating a branch:

the petals are white, flecked with pink and yellow; and the stamens are generally of the exceptional number seven, two being intercalated between the normal five. Only the lower flowers produce fruit, the upper ones being staminate. The fruit is spinous, and the six ovules only give rise to one, two, or three of the dark-brown seeds. The soft white wood is of little use. The "nuts" are too bitter for human food, but are eaten by goats and deer. Pure starch can be prepared from them, and, when mixed with twice the quantity of wheat-flour, they afford a strong bookbinder's paste. Several species are natives of North America, where they are known as Buck-eyes, some of them having yellow, pink, or scarlet blossoms.

Horse Mackerel, a book-name for fishes of the Acanthopterygian family Carangidae, from tropical and temperate regions. The type-genus *Caranx*, with about 90 species, has the body more or less compressed, and the lateral line entirely or partially covered with plate-like scales. *C. trachurus*, the Common Horse Mackerel, about a foot long, is common round the English coasts, and is sometimes eaten, but its flavour is far inferior to that of the mackerel (q.v.).

Horse-power is the engineer's unit of power, or rate of doing work. From certain experiments made some years ago it was settled that the horse-power should be regarded as equivalent to 33,000 foot-pounds of energy performed per minute. Nevertheless, it requires an exceptional horse to supply energy at that rate for any considerable time, and the unit should therefore be regarded as quite arbitrary. Small engines are estimated by man-power, which is from 2,600 to 3,100 foot-pounds per minute. Indicated horse-power, or I.H.P. of a steam-engine signifies the power supplied by the steam that is actually passed into the cylinders. This is calculated from indicator observations of the changing pressure of steam throughout the stroke and of the number of strokes per minute. It is greater than the actual horse-power supplied by the engine for external use, there being waste in friction, etc., in the engine itself. The efficient power is called the brake H.P., which is invariably less than the I.H.P. of the same engine.

Horse-racing, especially in the form of chariot-racing, was a favourite sport amongst the ancient Greeks. It is mentioned in the *Iliad*, and formed a prominent feature both of the great national games and the local festivals. It was one of the chief performances which took place in the Roman circus (q.v.). Amongst the primitive Teutonic tribes it appears to have been connected with certain religious observances. Horse-races were held at Smithfield in the 12th century, and the Chester races date back to 1512. It was mainly owing to the patronage of James I. that horse-racing became a national sport in England. Much care was now expended on the training of horses and the instruction of jockeys. The prize at this time was usually a small ball or bell of gold or silver. Races took place at Newmarket in 1605,

and had become regularly established there in 1640. The races on Epsom Downs, then called Banstead Downs, were also established in the early part of the 17th century. Towards the middle of the century gold and silver cups came into vogue as prizes instead of bells. The sport continued to flourish under royal patronage, especially that of Queen Anne, who, besides instituting several plates, entered and ran horses in her own name. In her reign the Doncaster races were established (1703). A famous racer of this period was Flying Childers, who in or about 1721 ran 3 m. 4 f. 93 y. at Newmarket in 6 m. 40 s. The three great races for three-year-olds, the St. Leger, Oaks, and Derby (q.v.), were instituted in 1776, 1779, and 1780: the first (at Doncaster) by Colonel St. Leger, the two latter (at Epsom) by the twelfth Earl of Derby. The Oaks Stakes were so called from a seat of the Earl at Woodmansterne. As these two races take place in May or early June, whilst those at Doncaster are held in September, the winners of the two earlier stakes are brought into competition in the race for the St. Leger. The Ascot races, held on Ascot Heath, near Windsor, were established by the Duke of Cumberland, son of George II. They have always remained under the special patronage of the Royal Family, and occupy a very important place in the calendar of fashion. The Goodwood meeting, which dates from 1802, is held in July on the downs adjoining Goodwood Park, the seat of the Duke of Richmond, near Chichester.

Early in the history of horse-racing the "weight-for-age" principle was introduced, according to which the weight borne by each horse was proportioned to his age. But it was found that the reputation gained by the fleetest horses prevented competition, and "handicapping" was substituted. Under this system a greater or less weight is assigned to a horse according to his known or presumed powers, but it is very doubtful whether the result is really to place the competitors on the same level. Two-year-olds are not admitted to handicaps; like the three-year-olds they have races of their own, the most important being the Middle Park Plate, called the "two-year-old Derby," at the Newmarket Second October meeting. The chief handicap races are the Goodwood and Ascot Stakes, the Chester, Ascot, Goodwood, and Manchester Cups, the three Liverpool Cups, the Northumberland Plate, the Czarewitch and Cambridgeshire at Newmarket, the Great Ebor at York, the City and Suburban at Epsom, and the Lincoln Handicap. The Two Thousand and One Thousand Guineas for three-year-olds at Newmarket are run on the same terms as the Derby, Oaks, and St. Leger, for which they are preparatory—i.e. the horses carry equal weights, 8st. 10lb. The One Thousand Guineas and the Oaks are confined to fillies; in the others, which are open to both fillies and colts, the former are given an advantage of 3 lbs.

During the nineteenth century horse-racing made much progress on the Continent, especially in France. The French Derby (Prix du Jockey Club) was established in 1836, the French Oaks (Prix de Diane) in 1843; but the great event of the

racing year in France is the Grand Prix de Paris (in June). The sport finds favour also in Germany and Austria, and is now gaining ground in Italy. Foreign horses, mostly of English parentage, have often been highly successful on the English turf; thus the French horse Gladiateur won the Two Thousand, Derby, and St. Leger in 1865, and the Derby has since fallen to the Hungarian Kisber in 1876, the French Rayon d'Or in 1879, the American Iroquois in 1881, and the Italian Signorinetta in 1908.

Flat-racing in England is mainly under the direction of the Jockey Club, which is said to have been founded in 1750. Its rules were thoroughly revised in 1889. Besides the ordinary flat-racing there are steeplechasing (q.v.), hurdle-racing, and trotting (q.v.); the last is much in vogue in America.

Horse-radish (*Cochlearia Armoracia*), a perennial cruciferous plant native to eastern Europe, which has escaped from cultivation in England. It has a thick yellowish-white root with an acrid odour and pungent taste, for which the darker-coloured root of Aconite (q.v.) has been sometimes fatally mistaken. The horse-radish has large, oblong, serrate radical leaves, sometimes irregularly cut, and numerous small white flowers. The root, which is used as a condiment with roast beef and to a slight extent medicinally, owes its pungency to oil of mustard.

Horse-shoe, an iron rim of varying pattern used to protect the hoofs of horses. For a foot in good condition all that is needed is a plain shoe of about the same length and breadth throughout, well adapted to the shape of the foot. The "seated shoe," wider than the plain shoe, and therefore more serviceable in the case of horses with weak or flat soles, consists of a flat surface on which the crust rests and an inner portion sloping towards the sole. The shoes should be renewed after intervals of a month at longest. The removal of the old shoe requires great care. The subsequent paring should be confined to the rasping of the wall-surface on which the shoe has rested, the removal of the overgrown portions of the foot by means of the drawing-knife, and a final rasping round the lower edge of the crust after the shoe has been clinched. Except in the case of farm-horses employed on soft ground, the portion of the foot which has been exposed seldom needs cutting. The sole, frog, and bars should all be carefully preserved. As a general rule, five nails are sufficient, but when the horse has to draw heavy burdens seven or eight are necessary. To prevent tripping, the shoes for the fore-feet should be turned up a little at the toes. The hind-shoes are frequently turned down at the heels, and the inside heel is usually thickened.

Horsetails. [EQUISETUM.]

Horsley, SAMUEL (1733-1806), prelate and man of science, was born in London and educated at Westminster and Cambridge. He was elected a fellow of the Royal Society in 1767, and became one of the secretaries in 1773, but in 1784 he resigned

his membership owing to his opposition to Sir Joseph Banks (q.v.). He was for many years engaged in an acrimonious controversy with Priestley, occasioned by the latter's *History of the Corruptions of Christianity* (1782). He was raised to the see of St. David's in 1788, and became Bishop of Rochester in 1793 and of St. Asaph in 1802. Bishop Horsley published some scientific and other treatises, and edited the works of Newton (1785).

Horsok, a compound term applied collectively to the Hor-pa and Sok-pa, the two leading nations of the northern province of Katchi, Tibet, from the Karakorum to the Kuen-lun Mountains. The Hor, whose domain lies in the west, are of Tatar, the Sok of Mongolic descent; but both are nomadic, roaming southwards into Bod-pa, that is, the settled Tibetan provinces. They are also for the most part Buddhists, and are bilingual, speaking both Tibetan and a common Mongolo-Tatar dialect. A few of the Hor-pa are Mohammedans.

Horticulture. This is now a branch of industry and recreation of great extent, variety, and importance, embracing as it does all that belongs to the garden, lawn, and orchard. Referring first of all to the out-door garden as the most important branch of horticulture, in this as in other countries with suitable climates, one cannot but be struck with the great increase within the last few years of the culture of hardy flowers in our gardens in the place of the tender "bedding" plants so much in vogue a few years ago. This "bedding out" craze had much to answer for in crippling a gardener's knowledge and effective use of the many fine hardy flowering plants which were so long neglected.

Bold masses of plants, especially of such things as tea-roses (which, by the way, are the most perpetual in flowering of all the roses), free-flowering and strong-growing types of carnations, pinks, pansies, especially of the kind called "tufted" lavender, the large-leaved saxifrages, spireas, and other things too numerous to mention here, are most effective for spring and summer flowering. In autumn, too, the flower garden can now be well furnished with such fine plants as the perennial sunflowers (*Helianthus*), cone-flowers (*Rudbeckia*), chrysanthemums, hollyhocks, etc., and in the very late autumn the Michaelmas daisies (asters), planted in bold groups, are invaluable. Then, again, much better use is now made of the many fine flowering shrubs our gardens possess, by planting them in bold groups in well-prepared soil, and not frittering the effect away by dotting them here and there with no heed to the surroundings or locality. With regard to the all-important matter of outdoor, and indoor, vegetable and fruit culture, the increased attention paid to this matter in recent years by market-growers especially, is little short of marvellous—indeed, the amount of produce that a first-class market-gardener will get off a comparatively small area of ground by the aid of deep culture, liberal manuring, and keeping the land free of weeds is enormous both in bulk and quality. This latter matter of quality is often lost sight of by small growers and private gardeners, who market their produce, and hence, because they send

inferior stuff into the market, the returns are always unsatisfactory, and the business is carried on at a certain loss. Market-gardening can only pay when the output is first-rate in quality and very large in bulk. This applies equally to produce that is "forced" or raised with the aid of artificial protection and heat as to the outdoor crops. Fruit culture has also increased enormously of late years, and fruit-farms of large extent are being laid down yearly, and with every chance of success, especially where facilities exist for the immediate disposal and proper storage of fruit that will keep, like good late apples, of which we are never likely to get in this country an over-abundance. The chief thing in fruit-farming to note is to plant a good selection of sorts few in number, but good breadths of each one kind, selected according to its market value and suitability for the locality. Before embarking largely in this fruit industry, anyone should find out a good spot with a proper soil and favourable climate, and near to a railway or some other means of easy access to a market. Soft fruits such as strawberries, raspberries, etc.—can be very profitably used for jam. The drying of fruit, such as apples, etc., as practised in America, should also receive far more attention than has hitherto been the case from our fruit-growers. A remarkable increase has also taken place in recent years in the culture of grapes under glass by market-growers, and we now have vineyards covering acres of ground, the output being enormous, and in some cases we should imagine that the prices obtained are far from remunerative. Tomatoes are also now produced in enormous quantities under glass, and, if of good quality, generally sell well. Peaches, if well managed under glass, no doubt still pay well. Pineapples are now no longer found remunerative, being replaced by the fine consignments to the markets of fruits from St. Michael's and other warmer climates where artificial heat is not required in the structures erected for their culture.

A great number of so-called new kinds of both vegetables and fruits have been added to our list of late years, and some of these are excellent; but it is best to proceed with caution in the selection of them, and when new kinds of fruit or vegetables are chosen it should only be those that are well suited to the locality in which they are to be grown. This matter of locality is a most important one, and because it is not heeded many failures result; a certain fruit or vegetable may do exceedingly well in one place on a certain soil, and entirely fail in another spot, however good the culture may be. Horticulture, to be successful, demands, above all things, a keen observation and great perseverance. Each apparently trifling operation connected therewith must be done promptly and thoroughly, and then profit and pleasure generally follow in due course. Not the least important factor in the greatly increased interest now apparent in matters connected with the garden is the fact of the existence of a well-organised horticultural press. Excellent and well-illustrated weekly and other journals filled with instructive matter are now within the reach of all, and this interchange of thoughts, opinions, and plans of

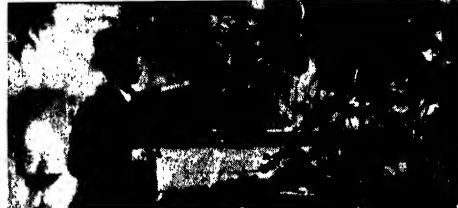
culture, etc., cannot fail to be of the greatest benefit to all attentive readers.

With regard to the humanising influence of horticulture on men and women, it would be difficult to over-estimate its far-reaching power and value. Trees, shrubs, and flowers are now gathered from every clime, and each one adds an attractive feature to the garden in its allotted spot. The care and industry requisite to obtain the best results from tending our favourite plants and flowers is of the highest value, and very many of our busiest workers in commerce, etc., find a change of occupation and a form of recreation thereby in the garden that nothing else can bring, and this very change of work quickens observation and thought, and thus we are all better enabled to do satisfactory work in life. A love of horticulture is undoubtedly a blessing to all who have a garden, however small.

Hosea, one of the twelve minor prophets. His book tells us that he was the son of one Beeri, a citizen of the kingdom of Judah, and that he prophesied in and after the reign of Jeroboam II., during the latter part of the 8th century B.C. His marriage to Gomer-bath-Diblaim, whom he divorced on account of her infidelity but afterwards received back, is symbolic of the rebellion and idolatry of Israel and the ultimate pardon of Jehovah. Of the fourteen chapters, eleven consist of denunciatory prophecies of a somewhat vague character, in which the social state of the kingdom is represented as extremely corrupt.

Hosier, SIR FRANCIS, naval officer, born about 1670, became a captain in 1696, and as such performed much assiduous and useful service, chiefly in cruisers. He was made a rear-admiral in 1719, and a vice-admiral in 1723, and in 1726 was sent as commander-in-chief to the West Indies, where the misfortunes of his fleet were unexampled. Hosier died of grief and disgust in August, 1727. His merit and misfortunes suggested to Richard Glover the subject of the well-known ballad *Admiral Hosier's Ghost*.

Hosiery, stockings and other textile fabrics made by knitting. Hand-knitting is said to have originated in Scotland in the 15th century. Machine-knitting dates from 1589, when the knitting-frame or stocking-frame was invented by the Rev. William Lee, a Cambridge graduate, born at Woodborough in Nottinghamshire. This machine consists of a number of hooked needles which are fixed in line and act together, yet in such a way that each controls the working of a single loop. Between each needle and that next it there is placed a thin plate of metal called a "sinker," which moves backwards and forwards, so as to force the thread of yarn—which is laid over the stems of the needles inside the hooks—into a series of loops. The needle then descends, and as it does so the hook comes into contact with a "presser bar," which forces the point of the barb into a groove in the stem of the needle, thus forming a closed eye, within which the loop is caught. As the needle descends farther, this loop is pulled through that which was last formed. The needle then ascends again and the operation is repeated, resulting in the addition of



1. Photo : T. Robinson, East Farleigh.

2. Photo : G. Garner, Southampton

HORTICULTURE.

1. A FINE BED OF ONIONS.
3. GRAVEL, GRASS, AND FLOWERS. A WALK IN THE GROUNDS OF BELMONT CASTLE, MEIGLE, N.B.
4. A CLUMP (TWO PLANTS ONLY) OF THE BEAUTIFUL WHITE ROSE FRAU KARL DRUSCHKI.

2. A FINE HOUSE OF MELONS.

another loop to the knitted fabric. All subsequent inventions in the hosiery manufacture have started from the principle of Lee's machine. The most important improvements were those of Jedediah Strutt (1758), who introduced a series of ribbing-needles, at right angles to the plain needles; of Sir Marc I. Brunel (1816), who invented the *tricoteur*, or circular stocking frame, for producing a tubular web, a machine which only became known in the improved form due to Peter Claussen (1845); and finally the tumbler needle of M. Townsend (1858). Since that date alterations for the better in the arrangement and construction of the knitting-frame have been made by William Cotton of Loughborough, and the Americans, W. C. Gist (1858) and Almet Reid (1877).

The chief centre of the hosiery trade in Great Britain is the town and county of Nottingham; it also extends to Leicestershire, Derbyshire, and other neighbouring counties. On the Continent Saxony takes the lead in this branch of industry. Machine-knitting is carried on very extensively in New York State and the New England states of North America. Cotton, wool, and silk are all employed in the hosiery manufacture. The articles produced comprise stockings, hats and bonnets, gloves, shawls, and every variety of underclothing. [The standard work on the knitting-frame is Felkin's *Machine-wrought Hosiery and Lace* (1867).]

Hospitallers. The Knights Hospitallers, or Knights of the Order of St. John of Jerusalem, afterwards known also as the Knights of Rhodes or of Malta, was one of the military orders which grew up in connection with the Crusades. Between 1023 and 1099 two hospitals were founded at Jerusalem by certain merchants of Amalfi, one for male, the other for female pilgrims. The church attached to the former was originally dedicated to St. John the Almoner, afterwards to St. John the Baptist. The germ of the order is to be found in an association of pilgrims who after their own recovery resolved to devote their lives to the service of the hospital. After the expulsion of the Turks from Jerusalem (1099), many Crusaders joined the body, and at the suggestion of their rector, Peter Gerard, they formed themselves into a religious order, which in 1113 received the sanction of Pope Pascal II. Under Gerard's successor, Raymond du Puy, the order was reorganised on a military basis. It was removed to Margat in Phœnicia in 1187, to Acre in 1287, and to Cyprus in 1291. In 1310 the knights captured the island of Rhodes, whence they were expelled by the Sultan Solymar in 1522. In 1530 Charles V. granted them the islands of Malta and Gozo with the city of Tripoli. The famous siege of Malta, in which the Turks were finally repelled mainly through the gallantry and determination of the Grand Master La Valette, took place in 1565. In 1798 the island was seized by the French. Since that time the order has almost ceased to exist; the office of Grand Master has been vacant since 1801, but a Deputy Grand Master is still appointed. The order originally comprised three classes—Knights, Chaplains, and Serving Brothers. The knights were divided into eight

"languages," those of Provence, Auvergne, France, Italy, Aragon, Germany, Castile, and England. Each language had several Grand Priories, to which were attached Commanderies or resting-places for pilgrims on the sea-coast.

Hospitals. charitable institutions for the relief or support of persons unable to satisfy their own wants. The term is now usually applied to medical hospitals or infirmaries whether general or special. The two oldest general hospitals in London—St. Bartholomew's (1547) and St. Thomas's (1553)—were originally religious foundations. Five more were added during the earlier half of the 18th century, which was a period of great activity in hospital-building—viz. the Westminster (1719), Guy's (1723), St. George's (1733), the London (1740), and the Middlesex (1745). One of the oldest of the special hospitals is Queen Charlotte's Lying-in Hospital (1752). Hospitals for consumption, ophthalmia, cancer, hip disease, and other specific diseases are now numerous in large towns in this country and on the Continent. Many of these complaints are excluded from the general hospitals. This is almost always the case with smallpox, scarlet-fever, and other contagious diseases, for which isolation hospitals are now provided under the control of the Metropolitan Asylums Board. With the exception of the last-mentioned class, which are supported out of the rates, and the naval and military hospitals, almost all hospitals are dependent on voluntary contributions. The chief hospitals in London and several other large towns serve a two-fold purpose; besides affording medical and surgical aid to the poor, and in cases of emergency to more opulent patients also, they furnish the best education in medicine and surgery by means of practical demonstration. In this manner the members of the medical profession in England receive an invaluable training in the great general hospitals. Up to a recent date very little regard was paid by the administrators of hospitals to the proper treatment of the inmates. The unsanitary condition of hospitals in former times, which is proved by the abnormally high death-rate, especially in lying-in hospitals, was due mainly to overcrowding, insufficient ventilation, a disregard of cleanliness in details, unsuitable diet, and, to a certain extent, the mixture of cases of different kinds. A great improvement has taken place in these respects owing to the greater attention now paid to construction, administration, and nursing. As regards construction, the first point to be considered is the selection of the most suitable site which is accessible to the persons for whom the hospital is intended. A dry soil should be chosen, and a free space should be left between the hospital and the neighbouring buildings. The number of patients placed in a single block should never exceed one hundred. This is now secured by adopting the pavilion form of building, in which a number of pavilions are connected by covered ways. The patients' wards should not occupy more than two storeys; if possible there should be one storey only in each pavilion. The wards should be completely separated

from the kitchen and other offices, excepting the lavatories, etc., intended for the use of the patient, and these should have a separate system of warming and ventilation. To ensure proper ventilation, the wards should be rectangular in form, with windows in each of the opposite walls. The breadth should be 25 or 26 feet, with a row of beds along each wall. The importance now attached to efficient nursing must be in great measure ascribed to the efforts of Miss Florence Nightingale. The nurses act under the direction of the medical staff, yet their position is one which requires a considerable amount of judgment, gentleness, and tact. It is only within recent years that "cottage hospitals" have been erected for the rural population; previously they were obliged to have recourse to those in the larger towns. They are built on the pavilion system, a cottage hospital resembling a detached portion of a larger one. Separate hospitals are now provided for children and convalescents, since in both cases the treatment required is of a special kind. In all civilised countries there are hospitals for soldiers and sailors supported by the State. The most important naval hospitals in England are those of Haslar, Plymouth, and Chatham. The chief military hospitals are situated at Netley, Woolwich, and Aldershot; in addition to these the principal stations have hospitals of their own.

A few words must be said about non-medical hospitals, i.e. those which afford a refuge to persons who are prevented by physical or mental incapacity from taking care of themselves. The alarming increase of poverty in the 16th century led many charitable persons to erect and endow buildings for the support of the aged poor. The number of such *almshouses* dating back to the 16th and 17th centuries is very large. From the reign of George II. onwards it was sought to secure the same end by means of *workhouses*, supported out of the rates and administered in connection with the poor laws (q.v.). Most institutions belonging to this class are now known by some other name, but there are instances to the contrary—e.g. *Funding Hospitals* (q.v.), and *Hospitals for Incurable Diseases*, such as chronic rheumatism, paralysis, and gout. To the latter group virtually belong the *Poor-law* or *Parish Infiraries*, which, since 1870, have taken the place of workhouses as a refuge for destitute persons suffering from chronic or incurable complaints.

Host (Lat. *hostia*, a victim), the consecrated bread used in the Roman Catholic Church in the celebration of the Eucharist, so called because in the doctrine of that church this sacrament repeats the sacrifice of the crucifixion. It consists of a thin wafer of unleavened bread, on which is imprinted a lamb or some other emblem. According to the judgment given in the Purchas case (1871) the use of the wafer is prohibited in the Church of England. The elevation of the Host takes place when the priest, after consecrating the bread, raises it above his head with both hands, that the body of Christ may be seen and worshipped by the whole congregation.

Hoste, SIR WILLIAM, BART., British naval commander, who was born about 1780, served with Nelson at Teneriffe in 1797, and was made a post-captain in 1802. In 1811 he gained a remarkable victory over a Franco-Venetian squadron of largely superior force. In 1813, in the *Bacchante*, he commanded the squadron which reduced Ragusa and Cattaro. For these services he was made a baronet in 1814, and in 1815 was given a K.C.B. He died in 1828, being still a post-captain.

Hostilius, TULLUS, the 3rd mythical King of Rome, succeeded Numa Pompilius in 670 B.C. He arranged the combat between the Horatii (q.v.) and Curiatii, and afterwards destroyed Alba, the inhabitants of which were transferred to Rome and placed on the Mons Cælius. He also subdued Fidene and Veii. He perished through the jealousy of the gods, who consumed his house with fire.

Hotham, the surname of a distinguished English naval family, of which WILLIAM, first Lord Hotham, born about 1732, in 1759 gained great credit for his share in the capture of the *Danœ*. In 1776, as commodore, he convoyed to America a fleet of transports laden with troops, and took part in the expedition against Rhode Island, and, in 1777, in that against Albany. In 1780, again as commodore, he shared in the relief of Gibraltar, and in 1787 was promoted to flag-rank. Appointed vice-admiral in 1793, he was immediately given the second command in the Mediterranean, and in 1794 succeeded Lord Hood as commander-in-chief. In the following year he defeated the French rear-admiral, Martin, and took from him two ships of the line. At the end of the year he resigned his command, and in 1797 was raised to the Irish peerage. He had been made a full admiral in 1795, and he died in 1813.

Hotspur. [PERCY.]

Hottentots, a South African people whose original home was the whole of the Continent south of the Zambezi, but who are now mainly confined to the south-west corner from about the parallel of Walvisch Bay southwards to the neighbourhood of Cape Town. Hottentot is merely a term of contempt imposed on them by the early Dutch settlers, apparently in the sense of "stutterers," "jabberers," in reference to the harsh, inarticulate sounds of their language. The most general national name is *Khoi-Khoi*, "Men of Men," or *Hou-Khoi*, "True Men," i.e. men in a preeminent sense, and these expressions are current amongst all three branches:—The *Namas* (Nama-qua) who give their name to Great and Little Namaqualand, and who are the present representatives of the race; the *Koranas* (Kora-qua) of the Middle Orange and Vaal rivers, and the half-caste *Griquas* of West and East Griqualands. Their origin and relations to the surrounding Bushmen and Bantu (Negroid) populations are questions still much discussed by ethnologists; but the most generally received opinion now is that they are a cross between these elements, speaking a language fundamentally the same as that of the Bushmen, and in their physical appearance holding a position

somewhat intermediate between the two. They are generally somewhat below the middle size, with disproportionately small hands and feet, feeble muscular development, broad flat nose, slightly oblique and deep-sunk eyes set wide apart, abnormally prominent cheek bones, which with the pointed chin give the face a decidedly triangular form. Other marked peculiarities are the large lobeless ears, large mouth with thick, pouting lips, yellowish brown skin like that of a European suffering from jaundice, short woolly black hair growing in tufts, highly dolichocephalic head with cranial capacity far below that of the negro, pronounced prognathism, and in the women the distinctively racial developments known as the *tablier* and *steatopygia*, which they have in common with the Bushman women. The Hottentot language, spoken with little variety by all the branches, shows little affinity with any other African tongue, except the Bushman, with which it agrees in genera, structure, vocabulary and the peculiar sounds known as klicks, which are unpronounceable by Europeans, and of which Bushman has six and Hottentot four (palatal, cerebral, dental, and lateral), occurring only before initial vowels and gutturals. Even more remarkable is the elaborate system of nominal and verbal inflections, and especially the three grammatical genders, which Hottentot has in common with Aryan; but all of which are found in no other linguistic family. The roots are monosyllabic, either concrete or formative, and these are joined together directly, not, as in Aryan, to the stem, that is, to a root modified for the purpose of receiving the inflections. Thus both in physique and speech the Hottentot-Bushman group stands quite apart from all other divisions of mankind. The Namas still preserve the tribal organisation and the nomad pastoral habits of the race. But in the Cape the tribes have been broken up and the chiefs replaced by magistrates since the beginning of the nineteenth century. Here also many speak Dutch or English exclusively, and all have been evangelised mostly by Protestant missionaries. Very few full-blood Hottentots are now found outside Namaqualand, and the so-called Gonaqua, or "Borderers," are a mongrel race of Hottentots, Kafirs, and "Mozambiques" (negroes from the east coast), thinly scattered over the eastern provinces of Cape Colony proper. Another degraded group are the "Hill Damaras" of Damaraland, for which see HERERO. At present the whole race scarcely numbers more than 200,000 altogether, of whom 20,000 Namas of pure descent, the rest Koranas, Griquas, Gonaquas, and others, mainly half-breeds. (N. H. J. Bleek, *A Comparative Grammar of South African Languages*, 1862, and numerous other writings; H. Hahn, *Die Sprache der Nama*, etc., 1870; G. Fritsch, *Die Eingeborenen Sud. Afrika's*, etc., 1872; Lady Barker, *Letters from South Africa*.

Hotti, a powerful Albanian tribe on the Montenegro frontier. They take their name from the village of Hot, which has always been their chief stronghold. They hold the first rank amongst the semi-independent tribes of North Albania, though

less numerous than some of their neighbours; population 6,000 to 7,000.

Houdon, JEAN ANTOINE (1741-1828), a celebrated French sculptor, was born at Versailles. After ten years' residence in Rome, where he produced his colossal statue of St. Bruno, he returned to France, and in 1777 was elected a member of the Academy. In 1805 he became professor in the Ecole des Beaux-Arts. Houdon excelled in portraiture, and his works include likenesses of Rousseau, Voltaire, Diderot, Washington, Napoleon, and many other celebrities.

Houghton, RICHARD MONCKTON MILNES, 1st BARON (1809-85), was born at Fryston Hall, Yorkshire, and educated at Trinity College, Cambridge, where he was the friend of Tennyson and Arthur Hallam. After leaving Cambridge, he travelled much abroad, recording his impressions in several volumes of verse, of which *Palm Leaves* (1844), dealing with Eastern life and thought, is the best known. But Lord Houghton's position in literary history is due rather to the keen interest he took in contemporary poetry and the advice and encouragement he held out to struggling young authors than to any writings of his own. Perhaps his best-known work is his *Life and Letters of John Keats* (1848). During his career in the House of Commons (1837-63) he was successively the follower of Peel, Lord John Russell, and Palmerston. He was ever on the side of liberty abroad and social progress at home; he supported the Italians and the Poles in their struggles for independence, and the First Juvenile Reformatories Bill was due to his efforts. His son (b. 1858) was Lord-Lieutenant of Ireland from 1892-95. He was made Earl of Crewe in the latter year. He became President of the Council in 1905, and Secretary of Colonies in 1908.

Hound, an inclusive term for dogs that hunt by scent, not by sight. [BEAGLE, BLOODHOUND, FOXHOUND, HARRIER, STAGHOUND.]

Hounslow, a town of Middlesex, 10 miles west of London. Near the town are extensive gunpowder mills and military barracks. It was once an important posting station, but its fame is mainly derived from the Heath which in old days was infested by highwaymen. The greater part of it is now enclosed.

Hour is a useful measure of time. It is the twenty-fourth part of the sidereal, solar, or mean-solar day, each of these giving a different value to the corresponding hour. The hour most familiar is that based on mean-solar time. In astronomical observations sidereal time is taken. [DAY.]

Housebreaking is the offence of breaking and entering a dwelling-house or building occupied therewith, or a school-house, shop, warehouse, or counting-house to commit any felony therein, or where a person commits a felony in any such building and then breaks out of it. The maximum punishment is 14 years' penal servitude. [BURGLARY.]

House-leek (*Sempervivum tectorum*), a plant belonging to the Crassulaceæ, native to the Alps, but commonly seen on the roofs of out-houses in

England and elsewhere, being supposed to be a protection against lightning, whence its German name "Donnerkraut." It has a rosette of fleshy spinously-pointed radical leaves, and multiplies itself by closely-grouped offsets. Its flower-stalk is pink and fleshy, and bears a flat reflexed cyme of pink flowers, each with about a dozen petals. The leaves contain malic acid, and are a popular remedy for bruises, swellings, stings, burns, corns, freckles, etc.

Housemaid's Knee. The bursa interposed between the patella or knee-cap and the skin is often affected by inflammation and chronic enlargement, particularly in those whose occupation compels them to frequently adopt the kneeling posture. Hence the term housemaid's knee is commonly applied to the condition of enlargement of this bursa, just as similar enlargement of the bursa over the elbow is known as miner's elbow. The treatment of housemaid's knee consists in the application of counter-irritants, such as iodine, with accompanying pressure; in some instances it may be necessary to puncture the swelling or even to dissect out the thickened wall of the bursa.

House of Commons, CLERK OF, an officer appointed by the Crown, whose duty it is to record the proceedings of the House, which are entered by himself or his deputies upon its journals. He also receives and takes charge of the petitions presented to the House, and generally assists the Speaker in the details of his onerous duties. Similar officers are employed in the House of Lords. By a statute passed in the reign of George III. the Clerk of Parliament is directed to indorse on every Act, immediately after the title thereof, the day, month, and year when the same shall have passed, and shall have received the Royal assent, and such indorsement shall be the date of its commencement where no other is provided by the Act.

Houses of Commons and Lords. [PARLIAMENT.]

Houston, a town of Texas State, United States, on the Buffalo Bayou, 49 miles N.W. of Galveston. It is an important railway centre and river port, shipping cattle, grain, and other commodities in large quantities.

Houston, SAMUEL (1793-1863), an American soldier and politician, was born in Virginia, but removed to Tennessee at an early age, and was on familiar terms with the Cherokee Indians, among whom he lived for three years. From 1813-15 he served in the United States army, rising to the rank of lieutenant. He then studied law, and in 1823 represented Tennessee in Congress, and became governor of the State in 1827. In 1830 he joined the Cherokee Indians, and took their part at Washington against the agents who cheated them. In 1832 he went to Texas, and during the war of independence he was commander of the Texas forces, and defeated Santa Anna's army. He was the first president of the new Texan republic, and when it became a state in 1845 he represented it in the Senate. He was made governor of Texas in 1859, but retired in 1861 upon the question of secession.

Houtman, CORNELIUS VAN, Dutch seaman, was commander, in 1594, of the first Dutch expedition to the East Indies; but on a subsequent voyage, on which he was accompanied by John Davis, the English navigator, he was murdered by the natives of Acheen. His brother FREDERICK, who also accompanied him, was at the same time taken prisoner, and during a two years' captivity compiled the first Malay dictionary, and made many valuable observations of stars in the southern hemisphere.

Hova (pronounced *Hova*), the ruling nation of Madagascar, who are chiefly confined to the province of Imerina, in the central part of the inland plateau. Of all the Malagasy peoples the Hovas have best preserved the original Malay type, though a distinct strain of Negro blood is betrayed in their frizzy hair and tumid lips. *Hova*, a term of doubtful origin, is properly the name of the middle classes, the nobles calling themselves *Andriana*, while the slaves are collectively known as *Mainti* or *Andero*. The Hova peasantry are industrious tillers of the land, courteous and hospitable, while those of the capital and other large towns have the reputation of being "past-masters in the arts of deceit and cajolery." They are, however, remarkably intelligent, mostly Protestants, well-educated and skilful craftsmen. Through the Hovas western culture is gradually spreading over the whole island, though its progress has been somewhat checked by the recent meddlesome interference of the French in the internal affairs of the kingdom. (*The Antananarivo Annual, etc.*, 1875-92; J. Sibree, *Madagascar and its People*, 1870; H. W. Little, *Madagascar: its History and People*, 1884.)

Hoveden, ROGER OF, an English chronicler of the 12th century who is thought to have been born at Howden in Yorkshire. He appears to have studied law, and to have become a member of the court of Henry II., whom he accompanied to France. The king sent him on a diplomatic mission to Scotland, and also employed him to negotiate with the abbeys at Reading with regard to filling vacant abbacies. In 1189 Roger was Justice Itinerant in the northern counties, and is thought to have retired into private life at the king's death, and to have written his history at this period, and possibly at Howden. He divides his work into two parts, the first dealing with events prior to Henry II.'s accession, and the second carrying the history down to the year 1201. Much of his work is an adaptation from earlier chronicles, but the record of the last ten years in his history is entirely original.

Howard, CATHERINE (circa 1520-1542), was the granddaughter of the second Duke of Norfolk and wife of Henry VIII., who married her after his divorce from Anne of Cleves in 1540. In 1542 Queen Catherine was arraigned, condemned, and beheaded, on a charge of immoral conduct before her marriage with the king.

Howard, CHARLES, LORD HOWARD OF EFFINGHAM, and, later, EARL OF NOTTINGHAM, seaman and statesman, was son of William, first Lord Howard of Effingham, and grandson of the second Duke of Norfolk, and was born in 1536. In 1569 he

held a military command during the Northern Rebellion. In the following year, however, he was made an admiral, and, though a Roman Catholic, was created a K.G. and Lord Chamberlain in 1574, and Lord High Admiral of England in 1585. In the following year he was one of the commissioners for the trial of Mary Queen of Scots, whose execution he strongly advocated. In 1588 he commanded in chief, with conspicuous ability and success, against the Spanish Armada, with his flag in the *Ark Royal*; and in 1596 he led the naval attack upon Cadiz, and for his services was in 1597 created Earl of Nottingham. In 1599, as an additional reward, he was made Lord-Lieutenant-General of All England. In 1601 he helped to suppress Essex's rebellion, and in 1605 he went as ambassador-extraordinary to Spain. These were his last services of importance. He died in 1624.

Howard, SIR EDWARD, son of Thomas Howard, Earl of Surrey and second Duke of Norfolk, was born about 1470, and, having been created Lord Admiral of England, distinguished himself in 1510 by defeating and killing the celebrated Scottish privateer, Andrew Barton. In 1512 he fought an indecisive action with the French off Brest, and in the following year, in a second action in the same neighbourhood, he was killed. As Lord Admiral, his brother SIR THOMAS, who in 1524 succeeded to the dukedom of Norfolk, followed him.

Howard, JOHN (1726-90), an English philanthropist, was born at Enfield, and apprenticed while young to a firm of grocers in the City of London. His father's death in 1742 enabled him to abandon this line of life and to spend a year in foreign travel. On his return to England he settled at Stoke Newington, and in 1752 he married. His wife's death in 1755 unsettled him, and he started for Portugal, but was captured by a French privateer and was for some time a prisoner of war. After his exchange he again settled down in England, and married a second wife, who died in 1765. He then went abroad to France, Switzerland, Italy, and Germany; and on his return to England he again settled down on his estate, and in 1773 became High Sheriff of Bedfordshire, an appointment which turned his attention to prison reform. His first efforts were directed against the practice of paying gaolers by fees, and investigations on this point led him to attack other abuses and shortcomings. His evidence before a Parliamentary Commission in 1774 resulted in the passing of two bills abolishing gaolers' fees and providing for a better sanitary condition in prisons. Howard then carried on his prison investigations in Scotland, Ireland, France, Flanders, Holland, and Germany, and in 1777 published the result of his labours in a book—*State of the Prisons in England and Wales, with Preliminary Observation, and an Account of some Foreign Prisons*. The rest of his life was spent in further inspection of prisons at home and abroad. He underwent in some places much difficulty and danger in carrying out his objects, and embodied from time to time the additional facts that came to his knowledge in new editions of his former work. His last journey abroad began in 1789, and early in

the next year he died of camp-fever in Kherson. His statue was erected in St. Paul's Cathedral, and was paid for by public subscription, and was, moreover, the first statue set up in the cathedral. There is a portrait of him in the National Portrait Gallery. His researches were carried out at his own expense, and were the undoubted cause of the many reforms in the treatment of prisoners that were introduced in the nineteenth century.

Howard, OLIVER, an American general, was born in 1830, and received his military training at West Point. In 1861 he commanded a volunteer regiment in the Civil War, and was made brigadier-general after the battle of Bull Run. He took part in many later actions, and commanded the right wing of General Sherman's army. In 1877 and 1878 he commanded in two Indian campaigns, and in 1884 he was enrolled in the Legion of Honour. He died in 1909.

Howe, JOHN (1630-1706), a Puritan divine, was born at Loughborough, in Leicestershire, in which parish his father was curate for some years till his suspension for alleged irregularity by the Court of High Commission in 1634. The son was a graduate of both Cambridge and Oxford, and was elected fellow of Magdalen College in the latter university, and, having taken orders, he was appointed perpetual curate first of Great Torrington and then of St. Saviour's, Dartmouth. Having pleased Cromwell by his preaching at Whitehall, he was appointed chaplain to the Protector, a post in which he won the respect of all. Upon the deposition of Richard Cromwell (1659), Howe, who had a high opinion of the unappreciated Protector, returned to Torrington, where he officiated, but not without persecution, till 1662, when he was ejected in accordance with the terms of the Uniformity Act. In 1670 he went to Ireland as domestic chaplain to Viscount Massereene, and five years later he became pastor of a Presbyterian congregation in London. In 1685 he went abroad and settled at Utrecht, but returned in 1687, and after the accession of William III. was a great advocate of mutual toleration and forbearance, and also of a union between Presbyterians and Congregationalists. His later years were quiet and uneventful. *The Living Temple* and his many other works were published in eight volumes in 1822, and there are memoirs of his life.

Howe, RICHARD HOWE, first Earl, was second son of Scrope, second Viscount Howe, and was born in 1726. At the age of fourteen he left Eton to accompany Commodore Anson to the South Seas, but participated only in the first half of that celebrated voyage. In 1743 he shared in the attack on La Guaira, and in 1745 was made commander and in 1746 captain. He took part in the expedition to Basque Roads in 1757, was commodore on the coast of Brittany in 1758, and fought at the battle of Quiberon Bay in 1759. From 1765 he was Treasurer of the Navy, and in 1770 reached flag-rank, and was made commander-in-chief in the Mediterranean. Promotion to vice-admiral followed in 1775, and in the following year Howe went as

commander-in-chief to the North American station, where he remained for two years. As admiral and commander-in-chief in the Channel in 1785, he relieved Gibraltar, and in 1783 became First Lord of the Admiralty. At the expiration of his term in that capacity, having previously succeeded to the family title, he was created Earl Howe. In 1792 he was made vice-admiral of England, and, upon the outbreak of war in 1793, returned to the Channel, flying the Union at the main by special order. After some preliminary skirmishing in 1794, he brought to action the French fleet off Ushant, and on "the Glorious First of June" defeated it. King George visited the Earl upon his arrival at Spithead, and presented the victor with a sword worth £3,150, a gold chain and a medal. Other honours were showered upon Howe, who, however, owing to growing ill-health, had to resign his command in the Channel in 1795 and that of the Western Squadron in 1797. In 1796 he was made Admiral of the Fleet and General of Marines, and in 1797 he received the Garter. He died in 1799.

Howell, JAMES (1594-1666), an English author, was the first to write an English handbook of foreign travel. He was the son of a Welsh minister in Carmarthenshire, and graduated at Jesus College, Oxford. Being sent abroad to find foreign workmen for some glassworks of which he was steward, he visited France, Spain, Italy, and Holland. Soon after he was sent with Lord Digby's embassy to Spain, and in 1632 he accompanied the Earl of Leicester's embassy to Denmark. In 1626 he had been appointed secretary to Lord Scrope, Lord President in the North, and in 1627 he sat in Parliament for Richmond, and in 1642 was made clerk of the Privy Council. From 1643-48 he was imprisoned for his royalist views. In 1660 he was appointed historiographer to the king. Besides his book on foreign travel his best-known works are a collection of *Letters (Epistles to Eliane)*, an English, French, Italian, and Spanish Dictionary, allegorical *Discourses of Trees*, a Spanish English Grammar, several Italian and Spanish translations, and a *Life of Louis XIII.*

Howells, WILLIAM DEAN, an American novelist, was born at Martin's Ferry, Ohio, in 1837. He began his literary career as a journalist. He wrote a life of Lincoln in 1860, and from 1861-65 he was consul at Venice, his *Venetian Life* being the result of his residence there. Having done much work as a journalist and critic, he became in 1872 editor of the *Atlantic Monthly*, a post which he held for some years. He likewise contributed to the *Century*, and to *Harper's Magazine*. His first novel, *Their Wedding Journey*, was published in 1871, and has been followed by a regular succession of others as to whose merits opinions are much divided. Among these may be mentioned *The Lady of the Aroostook*, *The Rise of Silas Lapham*, *An Indian Summer*, and *The Kentons*.

Howitt, WILLIAM (1795-1879), English poet and author, was born at Heanor, in Derbyshire. His first published work, a poem, appeared in 1814. In 1823 he married a lady, who was, like himself, a

member of the Society of Friends, and who also wrote much, sometimes in conjunction with her husband, and sometimes independently. A collection of joint poems was issued in 1827, and from that time a constant stream of works issued from their prolific pens, including *The Illustrated History of England* (for Messrs. Cassell). The pair published many works on local antiquities, and William Howitt translated from German and Swedish.

Howitzer, a field gun employed for high angle fire, for attacking positions which could not be reached with the ordinary gun, and for dropping shells upon an enemy secreted behind some obstacle, etc. The new British howitzer is the 4.5, capable of being fired at an angle of 45 degrees, and of discharging 10 rounds a minute. It replaced the 5.7 howitzer gun. Howitzers were largely employed by the Japanese in the war with Russia, and their success led to howitzer gunnery being developed.

Howker, vulgarly HOOKER, a small Dutch vessel of not more than 200 tons with main and mizen masts. Also a one-masted fishing-boat used on the south coast of Ireland. The name is, in addition, applied loosely and familiarly to any vessel.

Howler, HOWLING MONKEY, any monkey of the genus *Mycetes* with several species from Central and South America. They are large, powerful monkeys, with prehensile tails. The loud rolling noise whence they derive their name is produced by the enlargement of the hyoid bone and a strong muscular apparatus in the throat.

Howrah, a town on the right bank of the Hooghly, Lower Provinces of India, and opposite to Calcutta, of which it forms a suburb, communication between the two being carried on by means of ferry steamers and a pontoon bridge. The East Indian Railway has a terminus here, and there are important dockyards. In the neighbourhood are botanical gardens, and the Bishop's College.

Hoy, a small vessel usually rigged as a sloop, and used for the transport of passengers or goods from place to place, or from shore to ship: especially a vessel used for transport of powder, shell, etc., to men-of-war. The Dutch hoy has two masts.

Hoyle, EDMOND (1672-1769), the first of the series of writers upon whist, and other games. He is said to have been a barrister, and to have given lessons in whist. His *Short Treatise* was printed in 1742, and was followed by handbooks on backgammon, picquet, quadrille, and brag. Many editions of the *Short Treatise* have been issued, and it has been translated into French, German, and Italian. He also wrote upon the doctrine of Chances.

Huanaca. [GUANACA.]

Huaxtecs, an historical people of Mexico, who occupy the northern parts of the province of Vera Cruz between the sea and the Sierra Madre. The Huaxtecs are the northernmost branch of the Maya family, separated by numerous intervening

nations from the kindred peoples of Yucatan. At the time of the Spanish conquest (1520) they had already been settled from time immemorial in their present domain, which, according to some authorities, is the cradle of the Maya race. Their language is still spoken in Vera Cruz and San Luis Potosi, while the Totonac, another member of the same Maya family, is current in Puebla and in the southern districts of Vera Cruz. A Mexican writer describes the Huaxtecs as a powerful and wealthy people, who wore gold ornaments in their ears and lips, inserted sharp chips of white stone in the nostrils, and carried little round mirrors at their girdles.

Huber, FRANCOIS (1750-1831), a Swiss naturalist, whose special subject was the honey-bee, was born at Geneva. Early study led to disease of the eyes which resulted in blindness, and his minute observations upon the habits and history of bees were carried on through the devoted and systematic labours of his wife and a servant. His *Nouvelles Observations sur les Abeilles* has been translated into English. He also wrote other papers on kindred subjects, and his taste for natural history was handed on to his son.

Hubert, St., Bishop of Liège and patron of sportsmen, was the son of Bertrand, Duke of Guienne, and a courtier of Theodoric and Pepin of Heristal. Tradition relates that he was, when a layman, passionately fond of the chase, and that the appearance of a stag with a crucifix between his horns converted him as he was hunting on one Good Friday. He entered a monastery, and afterwards, when bishop, built a cathedral at Liège. One hundred years after his death, in 727, his body was translated to an abbey in the Ardennes, around which a town sprang up, owing to the resort thither of innumerable pilgrims. There is still a considerable traffic in medals, which are considered to be of efficacy as a preservative from hydrophobia. A picture in the abbey-church at St. Hubert illustrates the stag episode.

Hubli, an Indian town, in the Dharwar district of Bombay, 13 miles S.E. of Dharwar, and 230 miles S.E. of Poona. It is the centre of a considerable cotton trade, and its position on the main road to Poona gives it a vigorous general trade.

Huc, EVERISTE (1813-1860), a noted French missionary, was born at Toulouse. In 1839, being then a priest, he started on missionary work in China, where he learnt the language, and adopted the dress and, as far as possible, the habits of the country. For some time he presided over a mission centre in Mongolia, and studied the dialects and customs of the Tartars, and translated religious works for their benefit. In 1844 he set out with another priest, named Gabet, and a native Christian, upon the journey of exploration in Thibet which made their names famous, and which ended in their being sent back to Canton at the request of the Chinese ambassador. The *Souvenirs de Travels in Tartary, Thibet, and China* were translated into English by W. Hazlitt in 1851. *L'Empire Chinois* and *Le Christianisme en*

Chine have also been translated into English. Huc spent his latter days in ill-health at Paris.

Huddersfield, municipal and parliamentary borough (1 member) and market-town of the West Riding of Yorkshire, is on sloping ground near the Colne. The buildings are mostly of stone, and the town has been greatly improved and extended since its rise in manufacturing importance and its becoming the chief home of the fancy woollen trade. Among the public buildings are several churches and other places of worship, the cloth hall, the Armoury lecture halls, baths, Huddersfield college, technical school, and Gothic market-hall. There is a public park of 21 acres, given to the town by Mr. H. F. Beaumont, and bearing his name. Besides the manufacture of nearly every species of fancy woollen goods, the chief industries are silk and cotton mills, foundries, engineering and machinery works, organ factories, chemical and dye works. In the neighbourhood was the Roman station of Cambodunum, and the place itself is mentioned in Domesday. Coal is found in the neighbourhood, and there is a sulphurous spring. Robin Hood is said to have been buried near Huddersfield. Pop. (1901), 95,008.

Hudson, GEOFFERY (1619-1682), a celebrated English dwarf, born at Oakham in Rutlandshire. The story goes that he was brought to table before Charles I. and his Queen Henrietta, enclosed in a pie, and that he was then attached to the queen's suite. In 1630 he was sent on a mission abroad, and was captured by Flemish pirates. After his return from captivity he was made captain of horse. He was so unfortunate as to be again captured by pirates, and during this imprisonment he grew considerably. After the Restoration he was pensioned, but being accused of participation in the Popish plot, was imprisoned, and is said to have finished his life in prison. Scott introduces him with effect in the *The Fortunes of Nigel*.

Hudson, HENRY, English navigator, born about 1550, made four arctic voyages between 1607 and 1610, and on the last discovered what after him have been called Hudson Strait and Hudson Bay (q.v.). While returning at the close of the third of these voyages, he was cast adrift in an open boat by his mutinous crew, and was never again heard of. While in the service of the Dutch East India Company he had explored the coast of North America and the river which bears his name (1609).

Hudson Bay is an inland sea of British America, north-west of Canada, but included in the Dominion, between lat. 51° and 64° N., and long. 77° and 95° W., about 1,000 miles from north to south, with a greatest breadth of 600 miles, and containing, with its gulfs and inlets, 500,000 square miles. It is connected with the Atlantic by Hudson Strait, which is over 400 miles long and 100 broad. James Bay is a large gulf in the south, and Chesterfield Inlet extends a long way west. Hudson Bay is remarkably free from islands and shoals, except in the extreme north and at the entrance of the strait. From the middle of June to the end of October the bay is

navigable, but there is much drift ice in the winter. Many rivers flow into the Bay, among them being the Churchill, the Nelson, and the Severn on the W., the Moore and the Albany in St James's Bay, and the Great Whale on the E. The western coast is for the most part level and comparatively fertile, the eastern is lofty. Not much fish is found in the bay, though the white whale is sometimes taken.

Hudson Bay Company, a joint-stock company founded in 1670 for the purpose of obtaining furs and skins from North America. The charter of incorporation granted by Charles II. conferred on Prince Rupert and his seventeen associates the sole right of trading in the waters within Hudson Straits, and on the contiguous coasts, a region which was held to include all lands watered by rivers flowing into Hudson Bay. At the same time the government of this territory, which was called Rupert's Land, was placed in their hands, and they were encouraged to extend their trading operations by a promise of the same special privileges in all lands into which they should penetrate "out of the limits or places aforesaid." In 1685 the English were deprived of most of their factories by the French, but they were restored by the Peace of Utrecht (1713), and the French were never able to regain them. The trade of the Company prospered from the first, but they were slow to explore the interior, and as late as 1749 their possessions consisted merely of four or five forts on the shore of Hudson Bay. After Canada became a part of the British dominions (1763), they suffered much from the competition of the North-West Fur Company of Montreal. In 1821 the two companies sank their differences and obtained a joint monopoly, which was to extend throughout all the district to the west and north of the original settlement and to last for twenty-one years. A new licence was granted in 1838 to the Hudson Bay Company alone. On its expiration in 1859 the monopoly ceased, excepting in the Company's original possessions. These, however, were sold to the British Government in 1869, and in 1870 they were incorporated in the Dominion of Canada. But the Company still retains a considerable quantity of land, especially in the neighbourhood of its numerous forts.

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Hudson River is in the state of New York, United States of America, taking its rise in the northern part of the state, where its eastern and western branches have a course of 40 miles before uniting to flow 15 miles S.E. to Hadley Falls, then a rather longer distance N.E. to Glen's Falls, and then almost S. to New York Bay. Shortly below the junction of the streams the Sacandaga flows into the river, and 40 miles below Glen's Falls the Mohawk joins the stream. Many towns are upon the river, among them being New York, Albany, Hudson, Poughkeepsie, and Troy. The last 118 miles of the course of 350 miles are navigable for large vessels, and steamboats ply as far as Albany, 145 miles above the mouth. The scenery is often compared to that of the Rhine.

Hué is a town well fortified in the European style, about 10 miles above the mouth of the river Hué, which flows into the China Sea near the Gulf of Tonquin, and it is the capital of Anam. Besides the outer walls, five miles in extent, there is an inner citadel fortified with two walls, and containing the palace. Only small vessels can get over the bar at the river's mouth, where is a fort occupied by a French garrison, Hué also having a French resident.

Huelva, the name of a province and of a seaport town of Andalusia in Spain. The province, which is occupied in the north by branches of the Sierra Morena, is alluvial, and fertile in the south, and is rich in minerals, especially in copper, the working of which has been greatly developed of late. The town, which is 60 miles S.W. of Seville, is well built, and has some good squares, and has a brisk trade, especially in copper and other minerals, as well as in fruits and wines. Industries connected with shipping are also carried on. The value of the exports exceeds £5,000,000. A railway unites Huelva to Seville.

Huerta, VICENTE GARCIA DE LA (1730-87), a Spanish poet and critic, was born in Estremadura and, after a life of much adventure, settled down as head of the Royal Library. As a critic his efforts were turned to discouraging the Gallican tendencies of the time and to advocating a return to the old types of national literature, though he did not entirely carry these principles out in his own works. His best-known work is a tragedy, *Rachel*.

Huesca, the name of a province and of a town of Aragon in Spain. The province is on the French frontier, and contains some of the loftiest peaks of the Pyrenees. The south is more level, and the province has abundant pastures. The area is almost 6,000 square miles. The town, on the right bank of the Isuela, is 35 miles N.E. of Saragossa, and has good streets and squares, a fine Gothic cathedral containing some paintings, an ancient royal palace, and a university.

Huet, PIERRE DANIEL (1630-1721), was born at Caen and educated at the Jesuit's College there. He became with Bossuet joint tutor to the Dauphin, and had a share in the production of the Delphin editions of the classics. Later he took orders, and became Bishop of Soissons and of Avranches successively, afterwards, however, resigning his bishopric, and died as abbot of Fontenay. Among his works were his *Memoirs* in Latin, a *History of the Commerce and Navigation of the Ancients*, and books upon theology, philosophy, and history.

Huggins, SIR WILLIAM (b. 1824), English astronomer, early commenced the study of physical science. In 1852 he was elected member of the Microscopical Society, and a few years later devoted himself entirely to astronomy. He has made many important discoveries, and is a member of most of the scientific societies of England. In 1902 he was made a member of the newly-instituted Order of Merit.

Hugh, St. (1135-1200), Bishop of Lincoln, was born at Avalon in Burgundy. His father, who was Lord of Avalon, became a monk, and the boy was educated in the monastery. He became deacon at the age of nineteen, and in 1160 he joined the Carthusian order. In 1175 Henry II. brought him to the Carthusian convent at Witham, and in 1186 made him bishop. St. Hugh often offended Henry by his sturdy opposition, but regained his favour by his *bonhomie* and tact. He was loyal to Richard, but made an important point in constitutional history by opposing the granting of a subsidy to the king. The bishop was present at the coronation of King John. He almost rebuilt Lincoln cathedral, and when, after his death, miracles were reported to be worked at his tomb, he became the St. Thomas of the north.

Hugh, St. (of Lincoln), (1245-55), was a boy who was said to have been put to death by Jews, and his body was found in a well where its presence was miraculously revealed. His body was taken to the cathedral, and some of the Jews said to be implicated were imprisoned and hanged.

Hughes, Sir EDWARD, English admiral, born about 1720, became a post-captain in 1748, after having already seen much service. In 1757 he commanded the *Somerset* in Boscowen's expedition against Louisbourg, and in 1758 in the expedition to Quebec. He was subsequently commodore in the East Indies, and after his promotion to flag-rank in 1778 became a K.B., and rear-admiral on that station. There he fought five actions with the French under Suffren, and distinguished himself as a tactician and organiser. He had in the meantime, in 1780, been made a vice-admiral, and in 1793 he was promoted to be admiral. He died in 1794.

Hughes, THOMAS, born 1823, an English Q.C. and County Court Judge (1882), once Liberal member for Lambeth, is better known to most as the author of *Tom Brown's School Days*, and *Tom Brown at Oxford*, and *The Scouring of the White Horse*. Both in Parliament and out of it Mr. Hughes made himself the advocate of many schemes for the advancement of the well-being of the working-classes, and he was one of the earliest promoters of the principle of co-operation in conjunction with Kingsley and F. D. Maurice. He died in 1896.

Hugo, VICTOR MARIE (1802-1885), a great French poet and novelist, was born at Besançon. His father, an officer, followed the fortunes of Joseph Bonaparte into Italy and Spain, being accompanied to these countries by his son, who displayed a taste for writing verses when only 12 years old. In 1823 he produced his first novel, *Han d'Islande*, and in 1828 a full edition of *Odes et Ballades*, having the year before brought out his play *Cromwell*, which gave the first impulse to the war between the Classicists and Romanticists, which culminated in the production of *Hernani* in 1830. Then followed many dramas such as *Marius Delorme*, *Le Roi s'amuse*, *Lucreëe Borgia*, *Mario Tudor*, *Ruy Blas*, etc. This work, however, did not exhaust his energies, for he published during this period the novel *Notre Dame de Paris*, and *Les*

Renueilles d'Automne, and other poems in his best style. He also wrote critical essays, and contributed to a review. He was admitted to the French Academy in 1841, and in 1845 Louis Philippe made him a peer of France. From 1848 to 1851 he was engaged in politics, at first on the Conservative side and then on the Democratic, and the *complot* saw him flee to Brussels, where he wrote the first of his bitter attacks upon Napoleon III. He then went to Jersey and afterwards to Guernsey, where he remained till the establishment of the French Republic. It was during this period that some of his books best known to English readers were published. Such are *Les Misérables*, *Les Travailleurs de la Mer*, *L'Homme qui Rit*, and many of his later poems. Of the several works written after his return to France in 1870, perhaps the most notable is *L'Histoire d'un Crime*. Victor Hugo's faults seem to have lain in the direction of self-consciousness and exaggeration.

Huguenots, the former name of the members of the Protestant Church in France. The word is a corruption of the German *Eidgenossen*, "sworn confederates," and was imported from Geneva, where it was used as a political nickname. The French reformers were at first disposed to favour the views of Luther, but by the middle of the 16th century the movement had assumed a thoroughly Calvinistic character. As such it was bitterly opposed by the Court, and the persecutions to which the Huguenots were subjected drove them to take up arms in 1560. The ensuing struggle was due almost as much to political as to religious causes, especially in its later phases, for the adhesion of many of the discontented nobles and the thorough organisation of the party on a more or less democratic basis made it a grave source of political danger. The contest was continued intermittently for nearly forty years, war alternating with peace, according as to whether the royal party conceived that they had more to fear from the Huguenots or from their adversaries, the Guises (q.v.). Eight short wars are reckoned during this period, each terminated by a peace from which the Huguenots derived some temporary advantages. Their leaders were at first Louis de Bourbon, Prince de Condé (q.v.), and the Admiral Coligny (q.v.); after the death of the former at Jarnac in 1569, Henri, heir to the throne of Navarre, afterwards Henri IV. of France (q.v.), was put forward by his mother, Jeanne d'Albret, as their political champion. On one occasion, when the influence of the Guises was paramount, the Court party had recourse to treachery, but the massacre of St. Bartholomew (1572), terrible as were its immediate effects, failed altogether in its purpose of eradicating the Huguenots—perhaps the most serious injury it inflicted on them was the loss of their leader Coligny. The treaty of 1573, granting the Huguenots freedom of worship at Montauban, Nîmes, and La Rochelle was the model for numerous subsequent arrangements of the same kind, with the result that these places ultimately became Protestant strongholds. The Roman Catholic cause was apparently strengthened by the formation of the "Holy League" (1576),

but this association was really intended to promote the ambitious designs of the Guises, and with their fall it came to an end. The accession of Henri IV. seemed to promise a new era for the Huguenots, but the Edict of Nantes (1598) by no means satisfied their aspirations, as it did little more than repeat the provisions of some of the previous edicts. Peace was maintained during the reign of Henri, but under his son, Louis XIII., hostilities were again resumed. The efforts of the Huguenots to improve their position were, however, brought to a fatal close by the reduction of La Rochelle, after a gallant resistance, in 1629. From this time forward they were deprived of all military and political power, but contributed greatly to the material prosperity of France by their skill and industry in every department of trade. But Louis XIV., who in religious matters was influenced by the Jesuits, resumed a policy of persecution, and even before the revocation of the Edict of Nantes (1685) vast numbers of Huguenots had already left the country. Most of those who remained took refuge in the mountains of the Cevennes, where in 1704 they broke out into a rebellion which lasted for two years. [CAMISARDS.] In the 18th century a spirit of toleration grew up, which was gradually extended to the Huguenots, although it was not until 1789 that they regained their lost privileges.

The Huguenot families which found a refuge from political and religious tyranny in England have exercised an important influence on her industrial history. In the reign of Elizabeth they settled in large numbers in London, Canterbury, Coventry, Southampton, and other towns. From the first they were allowed perfect liberty of worship. The Spitalfields silk industry grew up with the emigration which took place after the revocation of the Edict of Nantes. Among other industries for which England is specially indebted to the Huguenots may be mentioned those of linen, paper, clocks, glass, locks, and surgical instruments.

Huia, or NEW ZEALAND WOOD CROW (*Hetero-locha dentirostris*), a rare New Zealand bird, by some authorities classed as an aberrant crow, and by others as a starling. It is remarkable for the fact that the bills in the two sexes differ in shape and size.

Hull, or KINGSTON-UPON-HULL, one of the chief ports of England, is a municipal and parliamentary borough (3 single-member divisions), in the East Riding of Yorkshire, and on the north shore of the Humber estuary, at the point where the river Hull falls into the estuary, 20 miles from the mouth of the Humber, and 34 miles S.E. of York. The town stands on low ground protected from the river by embankments, and is built mostly of brick. The old cruciform parish church of the Holy Trinity is one of the largest parish churches in England. In many of its features the building bears a striking resemblance to Beverley Minster. The church of St. Mary, Lowgate, is Perp. Among other principal public buildings are many other churches and places of worship, the town-hall, the exchange, corn-exchange, new market-hall, dock offices, grammar school, free library, opera house, Hull and East Riding College, etc. The Trinity house (founded

1369) is one of three institutions of this name, the others being at London and Newcastle. Its purpose is twofold—the relief of members (called "brothers") or their widows or children, and the supervision of buoys and beacons along the coast of the Humber. The Merchants' Exchange, in Italian style, occupies the site of the mansion of the De la Poles, Dukes and Earls of Suffolk in the 15th and 16th centuries, who were descendants of a merchant of this town. Hull is served by five railway companies, and has a good railway station. There are several public parks. The great industry of Hull is connected with shipping, and the dock accommodation makes it the third port in the kingdom. There is a large coasting trade, and a brisk foreign trade with the Baltic, America, the Mediterranean and other places. The docks belonging to the Hull Dock Company comprise 140 acres, and there are also 40 acres of other docks, and graving-docks as well. The chief industries beyond those relating immediately to the docks are ship-building, iron-foundries, machine-shops, seed-crushing, chemicals of various kinds, cotton and flax mills, canvas, rope, and cable-making, and the manufacture of tobacco. The town also sends out many large fishing fleets. Edward I. granted a charter to the town, and in 1359 it furnished 16 ships and 470 sailors. Both in the Civil War and in the Revolution Hull decided against the king, and the day of William III.'s proclamation at Hull is kept as a holiday. Among illustrious natives of the town was Andrew Marvell. Pop. (1901), 240,618.

Hullah, John, LL.D. (1812-84), an English music teacher and writer upon music, is generally looked on as the man who has done most to popularise music in England. He was born at Worcester, and learnt music from his mother. In 1832, after studying under William Horsley, he became a member of the Royal Academy of Music, and in 1836 he composed an opera. He was appointed Musical Inspector of Training Schools, but paralysis in 1880 put an end to much of his active work. It was he who introduced Wilhelm's method into England. Among his productions are the songs *The Sands of Dee* and *The Three Fishers*, a *Grammar of Vocal Music*, and similar books, and he contributed to periodicals.

Hulsean Professorship and Lecture-ship, THE, in the university of Cambridge, were founded in 1789 by the will of the Rev. John Hulse, a graduate of St. John's College, who bequeathed his property in Cheshire for their support. The holders of the offices were originally termed the Christian Advocate and the Christian Preacher respectively. The subject of the four annual lectures is "The Evidence for Revealed Religion," or some kindred topic. The lectureship is held for a year.

Humane Society, THE. The purpose of this institution, established in London by thirty-four private gentlemen in 1774, is to restore animation in those who are apparently drowned. Amongst other efforts for this purpose it maintains boats with life-saving apparatus on the Serpentine in

Hyde Park with printed instructions as to the method to be pursued. It also distributes numerous medals and other awards for gallantry displayed in the endeavour to rescue life, especially in cases of drowning.

Humanitarians, in theology, are those who deny the divine nature of Christ. [UNITARIANS.] The name is also given to the St. Simonians and others whose aim is to perfect the human race by a reorganisation of society; to the adherents of Auguste Comte [POSITIVISM]; and to those who, from repugnance to inflict pain, support the abolition of capital punishment, etc.

Humber, THE, a river estuary on the east of England, between the counties of York on the north and Lincoln on the south. It is about 35 miles long, and has an average breadth of 2 to 3 miles, opening out at the eastern end to 6 miles, and drains a basin of nearly 10,000 miles, such being the extent of land drained by the Ouse, with its tributaries Aire and Derwent, the Don, the Trent, and lastly the Hull. From the entrance of the Ouse the direction taken by the estuary is W. by N., and from that point to Spurn Head, S.S.E. The chief ports are Hull, Goole, and Great Grimsby, and navigation is easy for large vessels as far upwards as Hull, and small vessels can ascend to Goole, 20 miles farther inland, while Great Grimsby is almost on the open sea opposite to Spurn Head. Many towns have been in the course of time swept away by encroachments of the sea, and are now represented by sands.

Humboldt, FRIEDRICH HEINRICH ALEXANDER VON (1769-1859), a great traveller and naturalist, was born at Berlin, and after studying at Göttingen and other universities, started on a tour down the Rhine, visiting France, Holland, and England. In 1791 he went to Freiberg to study mining and botany, and from then to 1797 he was engaged in mining operations, resigning his appointment in the latter year for the sake of travelling. Having gone to Paris he made the acquaintance of Aimé Bonpland, a medical and botanical student, and, having got from the King of Spain permission to travel in the Spanish Colonies of America, he sent for Bonpland, and the pair started from Corunna. At Teneriffe they climbed the Peak to make atmospherical and geological observations. For five years they explored the regions of the Orinoco and Rio Negro, verifying the union of the Orinoco and the Amazon, and then spent some months in Cuba. In 1801 they returned to South America, and ascended the Magdalena, then went by land to Quito and as far south as Lima, crossing the Andes five times, and climbing Chimborazo and other peaks, and after a visit to Mexico and the United States they arrived in France, and Humboldt set about arranging the vast mass of materials they had brought with them, and, with the exception of short intervals, he remained there till 1827. His work on South America was published in three volumes, with atlas, from 1809 to 1825. In 1829 he set out in company with Ehrenberg and Gustav Rose on an exploring

expedition to Northern Asia, to examine the Oural and Altai mountains and the Caspian Sea, accomplishing 10,000 miles in nine months, and the results of this expedition, published by Rose and himself independently, gave a great impulse to research among men of science. For some years from this time Humboldt was engaged largely in political and court affairs, but he found time to publish a critical examination of the geography of the New World. His great work *Kosmos*, in four volumes, had a great influence upon science, and has been often translated. Bohn's *Scientific Library* contains in nine volumes translations of his *Travels, Kosmos, and Views of Nature*.

Humboldt, KARL WILHELM VON (1767-1835), brother of Alexander von Humboldt, German politician and author, was born at Berlin, where, as well as at the university of Göttingen, he studied law, and also gave attention to the philosophy of Kant, to antiquities, and the philosophy of art. He formed a friendship with Schiller, and published after the poet's death a correspondence that had passed between them. In 1801 his literary and artistic pursuits were to some extent interrupted by diplomatic work, and from 1806-8 he was minister-plenipotentiary at Rome. He then returned to Berlin as Minister of the Interior in matters touching religion and education, and had much to do with the founding of the Berlin University; but, being appointed ambassador to Vienna in 1810, he was for some years busied about the events which were leading to the growth of Prussian greatness. From 1819 he lived chiefly in retirement upon his estate, and gave himself freely to study. His collected works were published at Berlin in seven volumes (1841-43), and consist of poems, essays on divers matters, and treatises on language. His essay on *The Sphere and Duties of Government* is one of the earliest and most spirited defences of "individualism" or "*Laissez Faire*" in politics as against paternal government.

Hume, DAVID (1711-76), historian and philosopher, was born in Berwickshire, and, having been brought up under a clever mother, entered the Edinburgh University. He abandoned the law, which was distasteful to him, for philosophy and classics, and read steadily English, French, Latin, and Italian literature. In 1734 he went to France, and while residing there he wrote his essay upon miracles. On his return to England he published a philosophical work, the *Treatise on Human Nature*, his most important philosophical work. It fell dead, but two volumes of *Moral and Political Essays*, published in 1741-42, had a greater amount of success. For a time he was tutor to the Marquis of Annandale, and he became candidate for the chair of moral philosophy at Edinburgh and for that of logic at Glasgow, but in each case failed. He then became secretary to General Sinclair, and in 1751 went to London, and in 1752 published *Political Discourses*, which were well received. These contained the germ of the Free Trade doctrine. In 1752 his appointment as librarian to the Faculty of Advocates gave him the idea of writing history. The first volume, treating of the reign of James I. and Charles I.

appeared in 1754, and in 1756 the second volume, covering the period between the beginning of the Civil War and the Revolution. He then published two volumes on the Tudor period. The book gave offence by its support of Absolutism, but was for long a standard work. The money from his books, and a pension from the Crown, enabled him to spend the latter part of his life in learned leisure, varied by a visit to France as secretary to the ambassador Lord Hertford, during which visit he was made much of by French society. For ten years he remained there, and afterwards was Secretary of State for two years under General Conway, retiring then finally to Edinburgh. In philosophy Hume is an extreme sceptic, with a tendency (in the *Essays*) to a point of view like that of modern Positivism. On the one side his scepticism "woke Kant from his dogmatical slumber," on the other he anticipated J. S. Mill in many points. His *Treatise on Human Nature* and his *Moral, Political and Literary Essays* were re-edited in 1874 by T. H. Green and T. H. Grose.

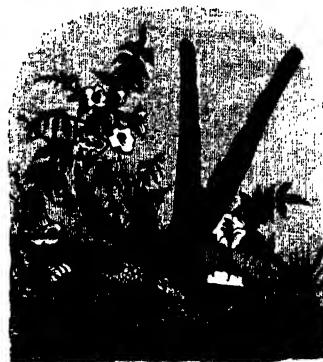
Hume, JOSEPH (1777-1855), a political and financial reformer, was born at Montrose. He was brought up to the medical profession, and made his studies at Edinburgh. He obtained an appointment as assistant ship's surgeon in the East India Company's service in 1797. He worked hard at Eastern languages, and in the Mahratta War acted as Persian interpreter in Lord Lake's army, besides doing medical duties, and filling other posts. Having thus accumulated a moderate fortune, he returned to Europe, and after an extensive foreign tour sat for a short time in Parliament. Losing his seat, and failing to become, as he desired, a director of the East India Company, he turned his energies to social reforms. Returned for the Aberdeen burghs, he attacked vigorously corruption and other abuses, and, though having no powers as an orator, he managed by his statistical knowledge and other qualities to obtain the respect of all parties during his chequered and somewhat intermittent parliamentary career.

Humerus, the bone of the fore-arm.

Hummel, JOHN NEPOMUK (1778-1837), musical composer and performer, was born at Presburg. He received his early education in music from his father, and was then trained by Mozart. At 10 years of age he accompanied his father on musical tours, and before the end of the century had composed several sonatas, trios, etc. He was then choir-master for a time to Prince Esterhazy, and made essays in a more ambitious style of composition. In 1816 he appeared in public as a pianist, and soon won fame, especially by his great powers as an improvisator. The latter part of his life was spent chiefly at Weimar, though he made foreign musical tours from time to time.

Humming Bird—so named from the noise made by the rapid motion of the wings—any species or individual of the Linnaean genus *Trochilus*, now raised to the rank of a family, *Trochilidae* (=Huxley's group *Trochilomorphiae*), and constituting, with the Swifts, the group *Macrochires*, from the

extraordinary development of that portion of the wing corresponding to the mammalian hand (*manus*). These birds, remarkable for their diminutive size and, generally, gorgeous metallic plumage, are confined to the New World, ranging northward from Tierra del Fuego to the island of



HUMMING BIRD.

Sitka, and ascending from the lowlands near the coasts to an altitude of 16,000 feet in the Andes. But by far the greater number of the more than 400 known species are found in the tropical forest-regions, whither those from the extreme north and south retreat when the short summer of the high latitudes comes to an end. The bill is slender, and in most cases long; the tongue is protractile, bifid at the tip, and admirably adapted for procuring the food, which consists principally of insects, supplemented by the nectar of flowers, though Wallace (*Amazon*, ch. v.) says that "they often take them [insects] on the wing like any other fissirostral bird." The wings, with ten primaries, are narrow and pointed, and worked by enormously developed pectoral muscles, the breast-bone being abnormally large to allow of their attachment. The tail, of ten feathers, varies greatly, and is often ornamented with plumes, sometimes with a racket-shaped web at the top. The feet are small and weak, and unfitted for progression on the ground. The skins form an important article of commerce, and are exported in vast numbers from Brazil to North America and Europe. The best collection of humming birds in the world is that at the Natural History Museum, South Kensington, acquired, with a number of unmounted skins, from the executors of the late John Gould, F.R.S. It furnished the material for Gould's great work (in five folio volumes) on the Humming Birds, and contains most of the specimens from which the magnificent plates were drawn.

Humus, or vegetable soil, is a dark-coloured loam containing the results of the decay of vegetable matter. Sometimes, as in the black earth of Russia, it may contain six or ten per cent. of organic matter, and it may cover thousands of square miles, as in the American prairies. It is very valuable for agricultural purposes, and in India is known as

cotton soil. Geologically, humus is interesting as furnishing a group of little-known but most active *humus acids*, to which the names *humic*, *umic*, *crenic*, and *apocrenic acid* have been applied, though it is doubtful whether they have been isolated. These acids have (1) a powerful solvent effect upon alkalies, alkaline earths, and even silica: they have (2) a great affinity for oxygen, and thus reduce peroxides to protoxides or to native metal, and sulphates to sulphides; and (3), possibly by neutralising alkaline solutions, they bring about the precipitation of silica, especially in or around organic structures, as in the formation of silicified wood, and possibly of flint. Much of the solvent action attributed to carbonic acid, because it results in the formation of carbonates, is probably due to them. The red, brown, or yellow peroxide of iron colouring many sandstones, is by them often converted into ferrous oxide and then removed as carbonate, bleaching the rock or, in intermediate stages, forming layers of lilac sand, such as are often seen under heathy moorland. Copper-ores in contact with decaying wood, or decomposing fish, have been reduced to native copper: native silver has been similarly formed; and gypsum has been converted first into calcium-sulphide, then into calcium-carbonate and sulphuretted hydrogen, and finally into layers of limestone and native sulphur.

Hundred, Hundreds. A hundred is a district forming part of a county, and governed by a High Constable or bailiff, and originally so called because each consisted of a hundred families of freeholders or ten tithings. A Hundred Court is much the same as a Court Baron, only that it is larger, and is held for the inhabitants of a particular hundred instead of a Manor; it resembles a Court Baron in not being a Court of Record, and in the free suitors being the Judges and the Steward the Registrar. Hundreds are persons empanelled or fit to be empanelled on a jury upon a controversy arising within the hundred where the land in question lies. The word "hundredor" also sometimes signifies he who has the jurisdiction of a hundred, and holds the Hundred Court, and sometimes it is used for the bailiff of a hundred. [CONSTABLE, TITHING.]

Hungary, a country of Europe lying between long. 16° and 26° E. and lat. 44° 30' and 49° 40' N., corresponds pretty nearly to the ancient Pannonia (W.) and Dacia (E. of the Danube). It takes its modern name from the Huns, who here made their first settlement within the Roman Empire. They were followed by the Avars (q.v.), a kindred tribe. Then for a time the district formed part of the Slavonic kingdom of Moravia, until about the beginning of the 6th century another Tartar tribe, the Magyars, appeared, and under their leader Arpad, by the middle of the century, had destroyed the Moravian power. They made, indeed, several attempts to push farther westward, but they were finally checked by the battle of Augsburg in 955. Under their king Geiza (972-97) their change from a nomad horde to a settled nation seems to have been completed, and they became

fixed in the country which they have ever since occupied. Geiza's second wife, a Polish princess, had been converted to Christianity; she persuaded her husband to be baptised, and about 994 his son received the name of Stephen. This prince, succeeding in 997, quickly spread Christianity throughout his dominions, and placed the kingdom under the patronage of the Pope. Since his time the kings of Hungary have always borne the title of "Apostolic Majesty." Stephen was also a lawgiver, and in every way the first civiliser of Hungary, and has since been honoured as a saint. Under Ladislas, also called "the Saint" (1077-95), further laws were enacted, and the first steps taken towards the annexation of Croatia, which came about in 1102 under his nephew and successor Koloman. Since that time Croatia (q.v.), though autonomous, has always been subject to the king of Hungary, holding, indeed, very much the same relation to that kingdom as Hungary itself has since 1526 done to Austria. During the reign of Geiza II. (1141-61) occurred the arrival of the Saxon colonists, whose descendants still occupy a large part of Transylvania. In this century, too, Hungary became engaged in foreign wars, against Galicia on one side and Venice on the other. From the partial submission of Galicia to Bela III. (1173-96) dates the claim made by Austria to that territory at the time of the partition of Poland. Against Venice the Magyar kingdom was less successful, and ultimately the town of Zara was lost. Under Andrew II. (1205-35) the kingdom fell into disorder. During his absence on crusade the power of the nobles and clergy had increased, and finally in 1222 Andrew, after an attempt to make all honours and offices hereditary, enacted what is known as the "Golden Bull," which fixes the privileges and rights of the nobles and landowners in terms often resembling those of our own Great Charter, but going further in recognising a right of rebellion in the subjects in the event of its violation by the sovereign. In the reign of Andrew's successor, Bela IV. (1235-72), yet another Mongol invasion took place, and Hungary suffered terribly. Frederick II., Duke of Austria, took advantage of this to extort three counties from Bela; but on the retirement of the barbarians Bela met, defeated, and slew Frederick in battle, but presently was worsted in a war with Bohemia. In 1278, however, Hungary had her revenge, and in alliance with Rudolf of Hapsburg, now Duke of Austria, and Emperor-elect, severely defeated Bohemia at the Marchfeld. With Andrew III. (d. 1301) the House of Arpad came to an end, and the crown of Hungary passed to a prince of Anjou, Charles Robert, son to Charles II., King of Naples, by Mary, daughter of Stephen V. He had some difficulty in establishing himself, but before the end of his long reign was not only firmly settled on the throne, but had much increased the importance of Hungary in European politics. His son Lewis (1342-82) succeeded in acquiring the crown of Poland as well, but as he died without a son, the Angevin dynasty ended with him. One of his daughters, Mary, had married

Sigismund of Luxemburg, and was duly crowned "king" (a term long remembered by the Magyars) of Hungary. Ultimately the Diet associated her husband with her in the office. He reigned for 55 years. During this time the Turks first became a pressing danger to Eastern Europe, and in 1396 the Hungarians and French in alliance suffered defeat at Nicopolis. It was in view of operations against the Turks that the light cavalry called Huszars (from husz—twenty, every twentieth man being conscribed) were first levied. In this reign, too, the system of representative government which has ever since prevailed in Hungary was first settled. Each county sent four representatives, who, with those from the cities, composed the Lower House. The Upper consisted of nobles, spiritual and temporal. The election of Sigismund to the empire in 1411, and his accession to the throne of Bohemia in 1419, were injurious to Hungary—the former as tending to merge her in Germany, the latter as mixing her up with the Hussite troubles at a time when the pressure of the Turks on her eastern frontier called for her undivided energies. Sigismund was succeeded by his daughter, Elizabeth, wife to Albert, Duke of Austria; but Austria had not yet secured the sovereignty. Albert died in the following year, and, though a posthumous son was born, he was set aside in favour of Ladislas Jagellon, King of Poland. By the aid of the great John Hunyadi (q.v.) Ladislas waged a successful war for some years against the Turks, recovering some territory for Christendom, but was defeated and slain at Varna in 1444. Albert's young son Ladislas "the Posthumous" was now elected, but the Austrians refused to give him up, and Hunyadi was appointed governor of the kingdom. Defeated by the Turks at Kossovo in 1448, he won a great victory over them at Belgrade in 1456, but died shortly afterwards. Two years later, on the death of Ladislas, Matthias, son of John, known to history as Matthias Corvinus, was elected king. He was successful both against the Turk and against the Emperor, and did much both as lawgiver and as a promoter of art and culture. He died in 1490, leaving no heir, and again a Ladislas of the house of Jagellon—this time, however, a king of Bohemia—was elected. Under him and his son Lewis (1516-26) the decay of Hungary began. Territory was lost on all sides, insurrection arose, Solyman the Magnificent captured Belgrade finally in 1521, and in 1526 Lewis himself perished in the battle of Mohacs, and Hungary as an independent kingdom ceased to exist. By the engagement in 1515 of the Emperor Maximilian's grandchildren Ferdinand and Mary to Anne and Lewis, daughter and son of Ladislas, the crown of St. Stephen passed to the ducal house of Austria (q.v.), and from the battle of Mohacs the head of the Hapsburgs has been king of Hungary and Bohemia. At the same time the relations between the Magyars and their German rulers have rarely been amicable. The former, used to constitutional sovereigns, were not disposed to acquiesce in Hapsburg autocracy. Several attempts were made at first to set up a native sovereign; and at least twice in the two

centuries following the union of the crowns Hungary sought the alliance of the Turks against Austria. Fresh difficulties arose as the Slavonic peoples gained strength, for the Magyar aristocracy have always been as slow to recognise the rights and aspirations of other nations as they have been forward to demand the recognition of their own. Maria Theresa (1717-1780) succeeded, partly by awakening the chivalrous feelings of the race, partly by her own ability and statecraft, in keeping Hungary loyal. During the Napoleonic period the Hungarians fought on the side of Austria, but when the national spirit revived in Europe it was not long before the demand for constitutional government was renewed. In 1848-9 war went on, and the Hungarian resistance was only put down by the help of Russia. After eighteen years more, during which the disaffection of Hungary had been a constant source of weakness to Austria, Francis Joseph was crowned at Buda, and since that time has governed Hungary as a constitutional sovereign.

Ethnology. Hungary is inhabited by so many distinct peoples, each speaking its own language and, to a large extent, retaining its own customs, that the term Hungarian is destitute of any ethnological sense; it simply means a native of Hungary, irrespective of his racial affinities. The dominant people, both politically and numerically, are the *Magyars*, of Finnish descent, who occupy all the provinces west of the Danube as well as the Pusztas, or great central plain watered by the river Theiss. Next in numerical importance are the various populations of Slav origin, who form altogether five distinct groups. The *Sloraks* and *Iuthenians* (*Rusniaks* or *Little Russians*) in the north along the slopes of the Carpathians, the *Serbs*, *Wends*, and *Croatiens* in the south, and especially in the valleys of the rivers flowing to the Danube. The third place, if not in point of numbers, at least in social importance, is taken by the *Germans*, who form large communities in all the towns, and who constitute the bulk of the population in Transylvania, where they take the name of Saxons. Next follow the *Wallaohians* (*Roumanians*), numerous especially in Bukovina and in the eastern departments generally. To these must be added the Jews, who form compact communities in many districts, several small groups of peoples such as the *Kumans*, *Yazyghes*, and *Szeklers* of Transylvania, akin to the Magyars; lastly the Gypsies, Armenians, and others.

Huns. A Mongol people, probably identical with the Hiong-nu of Chinese records, who harassed the north frontier of China from the second century before to the second century after the new era, and who later (5th century) were led by Attila across Asia and Europe as far west as Chalons-sur-Marne. That the great bulk of Attila's hordes were Mongols, or Mongolo-Tartars, is evident from the contemporary descriptions of these ferocious warriors, and of Attila himself, whom Priscus describes as a man of low stature, broad chest, disproportionately large head, small eyes, with scant beard, flat nose, dark complexion. But there can be no doubt that many other peoples, and especially Ugrian Finns, helped to swell the ranks of Attila's armies, so that

the term *Hun* has ceased to possess any clear or definite ethnological meaning.

Hunt, JAMES HENRY LEIGH (1785–1859), an English poet, author, and journalist, was born near London, and received his education at Christ's Hospital, of which he was a Grecian at the time of his leaving. Entering at first into the office of his brother, who was an attorney, he afterwards had a post in the War Office, where he remained till 1808, having already published some poems and contributed to his brother's paper, *The News*. In 1808 he, with his brother, started the Liberal paper, *The Examiner*, and the fearlessness of the brothers in its conduct brought them under the arm of the law. They were prosecuted and tried before Lord Ellenborough for an article against flogging in the navy. Mr. Brougham defended them, and the trial resulted in an acquittal. A second trial in 1812 for an attack upon the Prince Regent brought them a fine of £500 and two years' imprisonment. Leigh Hunt's cell became a literary centre, and he appears to have had a comfortable time in it. Several of his works were written at this period, one of these being the *Story of Ilimini*, which was ridiculed by Theodore Hook and others. In 1818 Hunt published a volume of original poems and translations, and in 1819 began a series of some of his best essays in the *Spectator*, a weekly paper then started. In 1822 he went to Italy to join Byron and Shelley in order to concert with them the scheme of a paper to be called the *Liberal*. Soon after Hunt's arrival Shelley was drowned; the paper only survived a few months, and Byron and Hunt parted, the latter living for some years in Italy. In 1847 the Liberal Government gave him a pension of £200. As a poet he excelled in word-painting to the point of exaggeration, and his prose style was easy and graceful. He was editor of various papers, and contributed much to periodicals. Among his more important works, which were very numerous, may be cited his *Autobiography*, *Table Talk*, *Legend of Florence* (drama), and *A Jar of Honey from Mount Hybla*. He also published editions of many of the older English dramatists, and one of Sheridan.

Hunt, WILLIAM HENRY, (1790–1864), an English water-colour painter, was born in London, and was a fellow pupil of John Linnell. He began to exhibit at the Royal Academy in 1807. Among his works are the *Boy Before and After the Mutton Pie*, a *Study in Gold*, a *Study in Rose Grey*, and *Too Hot*.

Hunt, WILLIAM HOLMAN, born 1827, a renowned English painter, made his studies at the school of the Royal Academy, and began to exhibit in 1846. Belonging to the Pre-Raphaelite school, he had a great circle of admirers. His *Claudio and Isabella* (1853) made a great sensation, and was followed the next year by the *Light of the World*, perhaps the most widely-known and admired of all his pictures. He then turned his attention to Eastern subjects, the most valued of his works in this direction being *The Scapegoat* (1856), the

Finding of the Saviour (1860) and the *Shadow of the Cross* (1873). In 1905 he was made a member of the Order of Merit, and published *Pre-Raphaelitism and the Pre-Raphaelite Brotherhood* in the same year. He died in 1910.

Hunter, JOHN (1728–93), celebrated anatomist, surgeon, and physiologist, was born in Lanarkshire. It was not till his twentieth year that he took a post as assistant anatomist to his brother William, then a surgeon practising in London. He showed so much talent, and studied pathology with such effect at Chelsea Hospital, that in 1750 he could take his brother's place in the dissecting-room. In 1754 he entered as a pupil in St. George's Hospital, and, after holding the post there of house-surgeon, became a partner in 1755 in his brother's anatomical school, where he lectured for some years. For his researches into comparative anatomy he was diligent in dissecting animals that died in menageries. He also experimented on living animals. In 1761 he went as staff-surgeon with the army to Belle Isle and to Portugal, gaining valuable experience in the treatment of gunshot wounds. In 1763 he set up in practice as a surgeon in London, and lectured in anatomy and surgery, but his greatest efforts were applied to the investigations, which an appointment in 1768, as surgeon to St. George's Hospital, and the consequent influx of paying pupils, enabled him to carry out more fully. Among his pupils were Jenner, and Sir Everard Home, afterwards his brother-in-law. In his later years he suffered greatly from heart disease, which interrupted his labours and eventually killed him. In 1776 he was appointed surgeon-extraordinary to the king, and in 1790 inspector-general of hospitals and surgeon-general to the army. Three years later the emotion consequent upon a dispute at a meeting of governors of his hospital killed him. He is best known to later times by his magnificent museum, now in the College of Surgeons, containing upwards of 10,000 preparations illustrating various branches of his science. He never finished a catalogue of it which he had begun, and after his death many of his papers were burnt by Sir Everard Home, for what reason is not clear. Among his more important writings are a *Natural History of the Human Teeth*, a *Treatise on Venereal Disease*, and a *Treatise on the Blood, Inflammation and Gunshot Wounds*. His works were collected and published in 1835.

Hunter, JOHN, naval officer, navigator, and statesman, was born in 1738. He entered the navy in 1754. He served as master of Howe's flagship during the American War. In 1786 he was appointed second captain of the *Sirius*, for the expedition to establish a colony in New South Wales. Hunter was made Governor of New South Wales in 1795, and remained in New South Wales until 1801. He died a vice-admiral in 1820.

Hunter, WILLIAM, M.D. (1718–1783), brother of the above, was born in Lanarkshire, and for some time studied theology at Glasgow University, abandoning this, however, later for medicine. In

1741 he went to London studying first under Dr. Smellie, then under Dr. Douglas, and attending St. George's Hospital as a pupil. In 1747 he became M.R.C.S., and began to practise, soon, however, confining himself almost entirely to midwifery, in which he was pre-eminent. He was appointed professor of anatomy to the Royal Academy upon its foundation in 1768. He collected a fine museum of anatomical preparations, shells, corals, etc., and some paintings, all of which was bequeathed to the university of Glasgow. Among his works are a *History of an Aneurism of the Aorta*, the *Anatomy of the Human Gravid Uterus*, and *Two Introductory Lectures*.

Hunter, Sir William, a noted statistician, was born in 1840, and was educated at Glasgow, Paris, and Bonn. In 1863 he entered the Indian Civil Service, and was (1866-69) superintendent of public instruction in Orissa. In 1868 appeared his *Annals of Rural Bengal*, and he wrote a *Comparative Dictionary* of non-Aryan languages. In 1871 he was made Director-General of the Statistical Department of India, and in 1878 was knighted. He has written a *Life of Lord Mayo*, a *Gazetteer of India*, and several other works, and edited a series of books called *Rulers of India*. He died in 1900.

Huntingdon, an inland county of England, lies between Northamptonshire and Cambridgeshire, which close it in on the N.E. and W., and has Bedfordshire to the S., and is watered by the Ouse. Its area is 229,515 acres, and in the N. it is very level, much of it belonging to the Fen district, but the surface varies somewhat in the W. and S. The soil is generally loam with clay and gravel, and is not particularly fertile, except on the meadow-lands, which are renowned for their richness. The agricultural farming is good, but there is little dairy-farming, and nothing remarkable about the breeds of sheep or cattle. The agriculture is improving, and several of the remaining lakes have been drained. Once part of Mercia, the county was forest, though little timber now remains, and remained for a long time under forest-laws. It returns two members to Parliament, being divided for this purpose into north and south. Pop. (1901), 57,773. HUNTINGDON, the capital, is about 60 miles N. of London, on the left bank of the Ouse, the site sloping down to the river. There are two fine old churches, and a large market-place, and the Great Northern Railway has a station. The corn and wool trade occupy many, and there are breweries, an iron-foundry, brickworks, and oil mills. Huntingdon was the birth-place of Oliver Cromwell. Pop. (1901), 4,281.

Huntingdon, Henry of (12th century), an English chronicler and author of the *Historia Anglorum*, was made Archdeacon of Huntingdon in 1120. His history extends to 1154. He also wrote some poems and letters on historical matters.

Huntingdon, Selina, Countess of (1707-1791), a noted religionist of her time, who warmly advocated the principles of Methodism, patronised George Whitefield, whom she appointed her chaplain, and gave her name to the followers of that

preacher. She founded a college in Wales, and built many chapels. Her father was Earl Ferrers, and her husband left her a widow in 1746.

Hunyadi, John Corvinus, a noted Regent of Hungary and general (d. 1456), was born in Wallachia. Having married a rich heiress he became a man of mark, and was chief of the party which bestowed the crown of Hungary upon Ladislas of Poland (1440). Ladislas made him Voyvode of Transylvania and commander of the southern provinces, in which capacity he carried on a successful warfare against the Turks, and concluded the peace of Szegedin in 1444, the breaking of which by Ladislas in the same year cost that king his life at the battle of Varna. After being defeated by the Turks at a later period, and captured by the ruler of Servia, who lost his ransom through the intervention of the Pope, Hunyadi was appointed for a second time (the first having been in 1445 after the battle of Varna) Regent of Hungary in 1452, and in 1455 drove the Turks across the Danube. In 1456 he defended Belgrade against Mahomet II., who was compelled to raise the siege, but a pestilence in his army forced Hunyadi to retreat, and was the cause of his death at Semlin.

Huon of Bordeaux, a romance belonging to the cycle in which Charlemagne appears as the central figure. Huon, Duke of Guinne, who is to suffer death because, in self-defence, he has slain a son of Charlemagne, receives a promise of pardon if he can make his way to Bagdad, kiss the emir's daughter, and return with his teeth and beard. With the aid of the dwarf Oberon and the princess Esclarmonde herself, who falls in love with him, he performs these exploits. The oldest version extant is in prose, and dates from 1454.

Hurd, Richard (1720-1808), an English bishop and author, was born at Congreve, in Staffordshire, and educated at Emanuel College, Cambridge, of which society he became fellow in 1742. His earlier works were editions of the *Arts Poetica* and other classics, and in 1757 he criticised Hume's *Essay on the Natural History of Religion*. He also wrote *Moral and Political Dialogues*, and *Letters on Chivalry and Romance*, and in 1772 he published his *Warburton Lectures*, delivered at Lincoln's Inn, under the title of "Introduction to the Study of the Prophecies concerning the Christian Church." He also published an edition of Bishop Warburton's works and Warburton's correspondence. In 1775 he was made Bishop of Lichfield, and was translated to Worcester in 1781.

Hurdygurdy, a musical instrument somewhat resembling a lute in form. It has four or six strings of wire or catgut, which are fastened to screw-pegs at the head. Two of these extend over the sounding board to the tail-piece, their sound being produced through the revolutions of a wooden wheel with a handle, which the player grasps in his right hand. The other strings are tuned as drones. The compass of the hurdygurdy is two octaves upwards from the tenor G. It was in use amongst the peasantry of several European countries during the Middle Ages.

Huron, LAKE, one of the five great lakes of North America, is bounded by Canada on the N., S., and E., and on the W. by the United States. It is 218 miles long from N. to S., and is 180 miles broad in its widest part, but the southern arm which receives the waters of the St. Clair river is only about 60 miles in the widest part. The large island of Manitoulin, which is the largest island of the lake and is 100 miles long, with a breadth varying from 4 to 25 miles, is inhabited. A part of the lake is cut off by this island and by a peninsula running up from the S. and ending in Cape Hurd. Georgian Bay, as this part is called, contains numerous islands, but none of any great size, while some are little more than dots. Lake Huron is fed by Lakes Michigan and Superior, and itself flows by the St. Clair river into Lake St. Clair, and from that by the Detroit river into Lake Erie.

Huronian, the name applied to a vast system of rocks occurring in the neighbourhood of Lake Huron. They rest unconformably upon the Laurentian (q.v.), and are older than the Potsdam or Lower Cambrian. They are from 10,000 ft. to 20,000 ft. in thickness, and consist of quartzites, greenish chloritic slates with conglomerates containing pebbles of Laurentian rocks, limestones—one band, north of the lake, being 300 ft. thick—and intercalated greenstones. No fossils have as yet been detected in them.

Hurons, an extinct North American people, whose name still survives in Lake Huron, on the shores of which they formerly dwelt. The Hurons were a branch of the Wyandot (Iroquois) family, but were at no time members of the Iroquois confederacy. On the contrary, they lived in constant warfare with the "six nations," by whom they were at last exterminated or dispersed in 1656; some are said still to survive amongst the Wyandots now settled in Quapaw Reserve, Indian Territory, and in other reservations in Kansas. The Huron language appears to have been the same as that of the kindred Erie nation, and differed considerably from the other Iroquois dialects.

Hurricane, any violent storm of wind, especially a circular one as experienced in the tropics. The velocity of the wind on these occasions sometimes reaches 120 miles an hour. According to the accepted Beaufort Notation, a hurricane has a force of 12, and the wind has a minimum velocity of 100 miles an hour, with a pressure of 49.2 lbs. per square foot. The fall of the barometer ranges from 1.0 to 2.5 inches, the rapidity of the fall increasing as the centre of the storm approaches. In hurricane districts any fall greater than 36 inch may be regarded as a sure warning of approaching danger.

Hurstmonceux, or HURSTMONCEAUX, is a village in Sussex, five miles north of Pevensey. Many excursionists from Eastbourne and Hastings visit the ruins of the fine castle, built by Sir Roger de Fiennes, one of the heroes of Agincourt, which passed (1727) into the hands of the Hare family, and was dismantled about 1800. Archdeacon Hare (rector 1832-55) lies buried in the churchyard.

The church, Early English, with Perpendicular windows, contains an altar-tomb of the second Lord Dacre.

Huskinson, WILLIAM (1770-1830), a prominent English statesman, was born in 1770, and in 1783 went to Paris to study medicine. He took part in the storming of the Bastille. In 1792 he returned to England, and entered political life as a supporter of Canning and Pitt. He was member for several constituencies. In 1814 he was Commissioner of the Woods and Forests; in 1822 President of the Board of Trade; in 1827 Secretary of State for the Colonies, and in 1828 Secretary of State for Foreign Affairs. Many restrictions on the trade of the colonies with foreign countries and many import duties were removed through him, so that he did much to prepare the way for Free Trade. He was run down by an engine at the opening of the Liverpool and Manchester Railway, and soon succumbed to the injuries received.

Huss, JOHN (1369-1415), the great Wyclifite reformer of Bohemia, was born at Hussinec (whence his surname Huss), near Prackaticz. He studied at the newly-established university of Prague, where he took the degree of Bachelor of Arts (1393), and Master of Arts three years later, and began to lecture in 1398. He became preacher at the Bethlehem chapel in Prague, 1402, and soon attracted attention by his bold assertion of the doctrines of Wyclif and his denunciation of ecclesiastical abuses, becoming popular with the commonalty and attracting some of the nobility. In 1403 he was elected rector of Prague University. At first Archbishop Sbinko was inclined to tolerate the plain speaking of the zealous, who, however, became an object of hatred and terror to the clergy, so that in 1408 he was deprived and suspended, and in 1410 excommunicated, while copies of Wyclif's writings were publicly burned in Prague. But in 1409 the Bohemian "nation" at the university had upheld King Wenceslas against the foreign "nations," with the result that the Bohemians received by royal edict thrice as much voting power as the rest, who accordingly withdrew from Prague, while Huss earned the protection of King Wenceslas. He therefore went on preaching and teaching in spite of renewed excommunications (1411, 1412), and a Papal interdict which was issued in 1413, as a retort to Huss's condemnation of the Bull published by Pope John XXIII., instigating a crusade against King Ladislas. In 1414 he was summoned before the Council of Constance, and, having obtained a safe conduct through the influence of King Wenceslas, he set out on the fatal journey, October 14th of that year, reaching Constance November 3rd. It was not thought obligatory to keep faith with a heretic, so that, in spite of his safe conduct, he was apprehended (November 28th) and thrown into prison. His accusers exhibited 39 articles against him, and in a full sitting of the council under the presidency of the Emperor (July 6, 1415), it was finally resolved that Huss had erred in all the points urged against him and that he must abjure his

errors and make a public recantation. As he stoutly refused to acknowledge that he had erred, he suffered death at the stake as a heretic, as did in the following year his friend and adherent Jerome of Prague.

Hussars, light cavalry troops marked by the peculiarity of their dress, the most conspicuous feature of which is the busby, a high fur cap, with a cloth bag hanging out of the top, on the right side. The name (Hungarian *huszár*, "twentieth") arose from the fact that when they were first raised by Matthias Corvinus, King of Hungary, in 1458, every twentieth man was taken from each village.

Hutcheson, Dr. FRANCIS (1694-1747), a distinguished metaphysician of the Shaftesbury school, was the son of a Presbyterian minister in the north of Ireland. In 1710 he entered the university of Glasgow, where he studied Latin, Greek, and general literature, and then theology. On his return to Ireland he opened an academy in Dublin. The issue of his *Inquiry into the Original of our Ideas of Beauty and Virtue* gained him high repute, and returning in 1729 to Glasgow as professor of moral philosophy, he proved a very successful lecturer. He is the best known upholder of the doctrine that moral and aesthetic distinctions are perceived by an innate "sense." His most important work, *A System of Moral Philosophy*, was published in 1755 by his son, FRANCIS HUTCHESON, M.D.

Hutchinson, JOHN (1674-1737), philosopher and theologian, born at Spennithorn, in Yorkshire, began his career as steward or agent to sundry peers, but was rendered independent by the Duke of Somerset that he might study physics (especially geology) and divinity. He became the founder of a sect or party which included Bishop Horne. He was a strenuous opponent of Newton's theories on vacuum and gravitation, the principles of his "Scripture Philosophy" being a *plenum* and air, while he ventured on a physical explanation of the doctrine of the Trinity. He founded the collection of fossils now known as the Woodwardian, belonging to the university of Cambridge.

Hutten, JACOB, a Silesian Protestant of the sixteenth century, was founder of an Anabaptist sect called Moravian Brethren. He advocated perfect equality, and was persecuted for his declamations against the authorities. He is said to have been burnt at Innsbruck; but the evidence is not conclusive. By degrees his sect entered into communion with the Swiss Church, and in 1627 became one with it. Later on the members of a sect founded by Count Zinzendorff, pretended to be their descendants, and took their title, *unitas fratrum*; but the connection is very doubtful.

Hutten, ULRICH VON (1488-1523), son of a Franconian knight, born near Fulda, where he was educated in a Benedictine monastery. From 1504-1514 he lived a wandering, unsettled life as a humanist student and poet. He then secured the patronage of Archbishop Albert of Brandenburg, Elector of Mainz. The following year he

devoted himself to satirising his cousin's murderer, Ulrich von Würtemberg, and was made laureate of the Empire 1517. From 1519 he tried to recommend Luther's tenets to the Emperor Charles V., the aristocracy, and the hierarchy, and also inspired and joined in the efforts of Von Sickingen to gain ascendancy for the Ritterstand (the knightly order) by overthrowing the princes and nobles of the empire. His devotion to these two causes proved his ruin. On Von Sickingen's defeat and death (1523), Von Hutten fled to Basle and appealed to Erasmus for help. Erasmus refused to see him. Thence ensued a bitter and contemptible controversy, which lasted until, while under the protection of Zwinglius, Von Hutten died on an islet in the Lake of Zurich. He was immoral, vain, and restless, but withal chivalrous and patriotic. He wrote much in Latin and German, both prose and verse. He was no doubt a substantial contributor to the famous satire on the ignorance of the monks and friars, *Epistola Obscurorum Virorum* (1515-1517), provoked by the attack of the Cologne theologians on Reuchlin and his *Augenspiegel*. The writings issued under his own name, with all their faults, promoted enlightenment and the development of literary taste in Germany.

Hutton, DR. JAMES (1726-97), a distinguished geologist and natural philosopher, to whose epoch-making work, *Theory of the Earth* (1st. ed. 1785), the subsequent advance of geological science in Great Britain is largely due. Born and educated at Edinburgh, on leaving the university he entered a lawyer's office; but soon gave up law for medicine, which he studied in Edinburgh, Paris, and Leyden, where he graduated as doctor (1749). From 1750, when he inherited a farm in Berwickshire, to 1754 he studied agriculture in Norfolk and abroad. From 1754-68 he resided on and managed his farm. After this, having let his farm, he lived in Edinburgh, devoted to scientific researches and enjoying literary and scientific society. His theories and methods were brought into prominence and developed by Professor John Playfair.

Huxley, RIGHT HON. THOMAS HENRY, was born in 1825. He became a student at the Charing Cross Hospital, and, having qualified, entered the Navy as assistant surgeon in 1846. His first zoological work was done in the *Rattlesnake*, engaged in the survey of the Great Barrier Reef, and the result of his investigations were published, in the *Philosophical Transactions*, by the Linnaean Society, and in the Ray Society volume on the Oceanic Hydrozoa. In 1851 he was elected F.R.S., and three years later became Professor of Natural History at the Royal School of Mines, and curator of the Museum of Practical Geology, and held these offices till 1885, when he retired into private life. As a biological teacher, Professor Huxley was from the first on the side of evolution. His scientific writings were very numerous; the most important of them are his *Anatomy of Vertebrated Animals* (1871), *Anatomy of Invertebrated Animals* (1877), the *Crayfish*, an *Introduction to the Study of Zoology* (1878), and in the front rank of the scientific work of the century

stand his Classification of Birds, and many of his papers in the *Journals* or *Transactions* of the various learned societies. Of a less technical character are *Man's Place in Nature* (1860-63), *Lay Sermons* (1870), *Critiques and Addresses* (1873), and *American Addresses* (1877). His little book on Hume is one of many proofs of his ability in philosophy proper. His *Essays on Controverted Subjects* (1892), with some others not collected, were originally addressed to magazine readers, and his destructive criticism of General Booth's "Darkest England" Scheme appeared in the *Times* (1890). Professor Huxley was examiner in the London University, and was chosen chairman of the association for making it a professorial university in Dec., 1892; Fullerian Professor at the Royal Institution, Hunterian Professor at the College of Surgeons, President of the Royal, Geological, and Ethnological Societies, and of the British Association, Lord Rector of the University of Aberdeen, a Royal Commissioner on Sea-fisheries, and an Inspector of Salmon Fisheries (1881-85). He received the Copley and Wollaston gold medals, and one from the Royal Society of New South Wales. Oxford, Cambridge, Edinburgh and Dublin, and several foreign universities, conferred honorary degrees on him, and he was a fellow or corresponding member of the principal learned societies at home and abroad. He was made a Privy Councillor in August, 1892. He died in 1895. His *Life*, written by his son, appeared in 1900.

Huygens, CHRISTIAN (1629-95), mathematician, mechanician, astronomer, and physicist, the Newton of Holland, was born at The Hague. His education was begun by his father Constantijn Huygens, the celebrated poet and diplomatist, continued at Leyden, under Vinnius and Schooten, and completed in the Juridical school at Breda. In 1649 he took part in the mission of Henry, Count of Nassau, to Denmark; but he soon gave up law and diplomacy for physical science, and gained distinction by attacking the unsound system of quadratures then in vogue. In 1654 he surpassed all approximations to the evaluation of the ratio of the circumference of a circle to its diameter. In co-operation with his brother, he made great improvement in the grinding and polishing of telescopes, and invented the achromatic eye-piece. The result was the discovery of one of Saturn's satellites (announced 1656), and of the ring (announced 1659). He invented the pendulum clock in 1656. From 1666 to 1681 he resided in France, where he produced his great work *Horologium Oscillatorium* (1673). On his second visit to England (1669) he was elected a fellow of the Royal Society, which still possesses three of his lenses of very long focal distance, which he made for aerial telescopes (1681-87). He established Hooke's wave theory of light, the resolution of the main undulation, and the explanation of the polarisation of light.

Husuls, a rude Karpathian people in Galicia, said by Franzöß to be "a hybrid, uniting the Slavonic blood of the Ruthen [LITTLE RUSSIANS] with the Mongolic blood of the Uzen, his speech betraying

the former, while his name testifies to the latter" (quoted by Miss Muriel Dowie in *A Girl in the Karpathians*).

Hwen Thsang, also written HIOUEN (HUVEN) TSANG (about 605-64), a Chinese Buddhist monk, and the most celebrated of those Buddhist pilgrims from China to India who have recorded their travels in quest of sacred objects and religious treatises. After travelling over China for several years as a teacher and a student of Buddhism, he settled at Chang-ngan (now Se-ngan-foo), where he became famous for his deep knowledge of sacred lore, and where he eventually died. In August, 629, he crossed the frontier, and plunged into the shifting sands of the Great Gobi desert. He crossed the Thien-shan mountains, over a glacier, and after much peril and suffering reached India, about which he travelled assiduously. He returned to China laden with precious books, etc., in 645, and was welcomed as a saint. His valuable itinerary was completed in 648. He translated into Chinese several Buddhist treatises brought from India.

Hyacinth (*Hyacinthus orientalis*), a liliaceous bulbous plant, native to Western Asia, and cultivated in Europe for more than three centuries, during which time countless beautiful varieties, the brightest ornaments of our borders in spring, have been evolved. The wild form has a loose raceme of only a few drooping flowers; but most sorts now cultivated have their flowers closely packed and horizontal. In colour they range from a deep, almost black, purple to a nearly true pale blue, to pink, deep red, yellow, and dead white, and they are rich in perfume. They can be grown either in soil, or in glasses nearly filled with water, if forced at first in the dark. The soil and climate of Holland is specially suited to them, and near Haarlem many acres are devoted to their propagation. Several species of the allied genus *Muscari* are also known as hyacinths, such as *M. botryoides*, the grape hyacinth, *M. racemosum*, the starch hyacinth, *M. comosum*, the tassel hyacinth, and the name "wild hyacinth" is often applied to the bluebell, *Scilla nutans*. The flower known to the Greeks and Romans as *lukūbos* (*hyacinthus*) has never been properly identified.

2. A hard transparent mineral, usually of a yellow colour, found in Ceylon and consisting of the silicate of zirconium $ZrSiO_4$, being identical with the mineral known as zircon.

Hyacinthe, PÈRE, ecclesiastical title of CHARLES LOYSON (b. 1827), born at Lyons, entered the Carmelite order. He attracted attention by his preaching at Bordeaux, Perigueux, and (1865-1869) at Paris. The boldness of his views led to his being denounced at Rome for heresy, and in 1870 the Pope relieved him of his monastic vows. His eloquence gave a transient vitality to the latest phase of the Gallican movement in France, a phase which he originated in sympathy with the "Old Catholic" movement. He married an American lady in London in 1872, and, Dean Stanley being his friend, delivered four lectures in London, 1876. In 1893 he delivered a series of addresses in the provinces of France, and transferred

his church in Paris to a Dutch body of Dissident Catholics.

Hyena, the sole genus of the family Hyænidæ, of the *Aeluroid* division of the Carnivora, from Asia and Africa. The name is also used for any individual of the genus. The dental formula is— $I_3, C_1 P_4 M_3 = 34$; the jaws are strong enough to crack the thigh-bone of a horse, and the tongue is rough as in the cats. There are four digits on each limb, with non-retractile claws, like those of the dogs, and the hinder ones are shorter than those in front, causing the body, which is covered with coarse, bristly hair, to slope towards the haunches. The tail is bushy, and there is a kind of reversed mane on the neck and withers. These animals are nocturnal, and very cowardly. They live principally on carrion, and so fulfil the useful office of scavengers, and dig up dead bodies from the grave. They often carry off sheep, and, it is said, occasionally children. The Spotted, or Laughing Hyæna (*H. croouta*), about 2 ft. 6 in. at the shoulder, with yellowish-brown fur, marked with round black blotches, and the Woolly, or Brown, Hyæna (*H. fusca*), a little smaller, with reddish-grey fur, brindled with brown and black, inhabit the country south of the Sahara. The Striped Hyæna (*H. striata*) is a native of Northern Africa, ranging eastward to the Himalayas. It is about the same size as the Woolly Hyæna, and has yellowish-brown fur thickly striped with black.

Hyalea, one of the best-known genera of the shelled Pteropods (q.v.) or Thecosomata. Like the rest of the class, it is marine and pelagic. Some fossils referrible to this genus have been found in the rocks of the Cainozoic period.

Hybridism, the crossing of distinct species of plants or animals, the term *mongrel* being used for the result of crossing two varieties of one species. The subject is of practical importance, especially in horticulture, as a means of introducing new forms; but of still more importance theoretically in relation to the theory of evolution. The principles of hybridism are much the same in the animal and the vegetable kingdoms.

There is no known authentic case of the fertile crossing of two species belonging to distinct families; but there are numerous cases, especially among plants, of such fertile crossing of species belonging to absolutely distinct genera. They are known as *bigeners* or *bigenetic hybrids*. Among orchids, for instance, it often happens that a plant belonging to genus *a* when pollinated by one belonging to genus *b* will produce seed; that not only will this seed grow, but that the plants thus produced may be pollinated by either of the parent forms, or even by some third species belonging to a third genus, *c*; and so on. Pollen from a plant of a distinct family, however, when placed on a stigma is as inoperative as so much mere dust.

It has been urged as an objection to the theory of evolution that distinct species are not, as a rule, capable of producing hybrids, and that such hybrids, when produced, are themselves sterile—the case of the mule, the domesticated hybrid of the horse and the ass, being a familiar instance in

point. It is argued that specific types have in this way been preserved immutable from the beginning. To this it may be replied:—(1) that, though the theory of evolution implies mutability of type, it does not suppose such mutability to have resulted from hybridism; (2) that the argument is mainly a circular fallacy, forms that are mutually sterile being, for that reason, ranked as distinct species, and then the conclusion drawn from them that species are mutually sterile; (3) that a distinction must be drawn between the sterility of the two species when crossed and that of their hybrid offspring, the two things by no means always varying together; and (4) that in this matter of sterility there is not the universal distinction, which is alleged, between the natural species of a genus in a wild state and the domesticated varieties of one species; but that the difference is only one of degree, cases occurring of every degree of fertility in the latter.

The facts of hybridism are often very remarkable. There is fairly conclusive evidence that our domestic races of dog have sprung from more than one wild species; but they are all now freely fertile among themselves. The hare and the rabbit have bred together, producing offspring extremely fertile with either parent form; but it is by no means a general rule that reciprocal crossings are equally fertile, i.e. that, if the male of species *A* produces fertile offspring with the female of species *B*, the male of *B* will do so with the female of *A*. Many closely-allied species cannot be crossed, or can only be so with difficulty, whilst others far more divergent in character may cross freely. Annual plants have been crossed by perennials, deciduous trees by evergreens, plants flowering at one season by those flowering at another, and natives of one country by those of another differing in climate. On the other hand, whilst several species of passion-flower (q.v.) can be readily crossed, they cannot be fertilised by pollen of their own species.

Darwin suggested, as an explanation of the admittedly frequent sterility of domesticated hybrids, the consideration that the reproductive system of an organism is the most delicately susceptible to slight changes in conditions such as domestication produces. It should, however, be borne in mind that in not a few cases domestication has induced, not sterility, but extreme fertility in hybrids.

Hydatid, the larval form of the tapeworm known as the *Tænia echinococcus* (which frequently occurs in the alimentary canal of the dog). The adult worm is never found in the human subject, but the eggs when swallowed by man undergo development, and cysts may be formed in various organs, particularly the liver and lungs, and these cysts by a very gradual process of growth may attain a considerable size. In the cyst are found numerous *scolex* heads, each with its four suckers and bundle of hooklets, resembling the first joint of the adult worm.

Hyde, a township and borough (since 1881) of Cheshire, $7\frac{1}{2}$ miles E.S.E. of Manchester. The town stands on the Lancashire coalfield, and enjoys ample facilities of communication by road, rail,

and canal. The growth of Hyde has been due entirely to the cotton manufacture, to which it is well adapted, owing to the abundance of water-power and coal. Both spinning and weaving are carried on extensively, and there are also iron foundries and engineering works. It has a Town Hall in Renaissance style, a Mechanics' Institute and Technical School, and numerous places of worship. The family of Edward Hyde (1609-74), Earl of Clarendon, is said to have taken its name from this place. This flourishing borough includes the townships of Hyde, Godley, Newton, and Gee Cross. Population (1901), 32,768.

Hyderabad, or the NIZAM'S DOMINIONS, the largest native state, occupies the centre of the Deccan, lat. 15° to $21^{\circ} 30'$ N., long. 75° to $81^{\circ} 30'$ E., including the old provinces of Hyderabad and Beeder. It is for the most part a tableland, 1,800 feet to 2,000 feet above the sea, with granitic ranges running N.W. to S.E. The chief rivers are the Godavery and Kristna. The climate is temperate, and much of the soil very rich and fertile, yielding grain, cotton, sugar-cane, and tobacco.

HYDERABAD, the capital of Hyderabad state, stands on the right bank of the Musi, surrounded by a wall six miles in circumference. It is one of the chief seats of the Mohammedan religion in India. The principal buildings are the grand mosque, built in imitation of that at Mecca, and the Residency.

HYDERABAD, the historical capital of the British province of Scinde, stands about $3\frac{1}{2}$ miles from the east or left bank of the Indus, above the junction of the Fulaiile branch. It is also the centre of postal, telegraph, and road communication for the district. The chief manufactures are silks, gold-work, pottery, and arms.

Hyder Ali (1728-82), son of a general of the Rajah of Mysore, who afterwards became tributary sovereign of Bangalore. He entered the Mysore army, and in 1749 became conspicuous for his bravery. He rose rapidly in rank and power until he deposed his master (1759), allowing him his title and a pension. The territory subject to Hyder Ali covered 80,000 square miles by 1767, when he made war on the British and dictated terms before Madras. In 1769 he made a treaty with them, but, resenting their refusal to support him after his defeat by the Mahrattas (1772), he again took up arms in 1780. Sir Eyre Coote routed his army at Porto Novo (1781).

Hydra. 1. A "water-snake," in Greek mythology a monster which dwelt near Lerne in Argos. It had nine heads, and when it was attacked by Hercules two new ones grew in the place of each which he cut off, but he at last destroyed it by burning the heads instead of cutting them.

2. The common fresh-water Polype, the type of the family *Hydridae* and order *Hydroida*. It is a small animal, living in ponds and ditches, attached by its base to the stems and leaves of water-plants. It consists of a small tube formed of two layers, an endoderm and ectoderm (q.v.), between which occurs the slightly-developed mesogloea

(q.v.); the tube is closed at the base. At the other end it is constructed to form the mouth, which opens on a raised area, or peristome, surrounded by a circle of hollow tentacles. The Hydra catches small organisms by its tentacles: the mouth opens into a cavity which is not separated from the general body cavity, the food is digested here and absorbed by the cells of the endoderm; there is no separate digestive cavity as in higher animals. It is hermaphrodite. It has long been believed that the Hydra has such a simple organisation that it can be turned inside out without injury, and its stomach will then act as the skin and vice versa; it was also believed that the animal could also be reproduced indefinitely by cutting it into pieces, each of which was asserted to grow into a fresh individual. Recent attempts to confirm these statements have been unsuccessful, though they have proved the Hydra to possess enormous powers of recovery from injury and reproductions of lost parts. Inversion was, however, always fatal, unless the animal could manage to wriggle back to its normal arrangement.

Hydragogue. [PURGATIVE.]

Hydrangea (*Hydrangea hortensis*), a popular conservatory and summer garden plant, introduced from China by Sir Joseph Banks in 1790. It is a low-growing shrub belonging to the saxifrage order, with opposite, rather large, oval, toothed, acute, light-green, deciduous leaves, and large globular clusters of pink flowers. The addition of alum or iron to the soil gives them a lead-blue tint. Almost all the flowers are neuter, having five large petaloid sepals and no petals, stamens, or carpels. The plant is propagated by cuttings.

Hydrastine, an alkaloid of composition $C_{21}H_{21}NO_6$ which occurs in the roots of the plant *Hydrastis canadensis*. It appears to be closely related to the alkaloid *narcotine*, and its properties and constitution have, with recent years, formed the subject of much chemical research and study.

Hydrates are compounds which are formed by the union of substances with water in definite molecular proportions. In some, these combining substances may unite chemically so that the water cannot again be easily eliminated; in others, however, the water appears to be more loosely combined than is usual in a true chemical compound, being driven away by application of moderate heat. Of this nature are many of the crystalline hydrates which many acids, salts, and organic compounds form with water, e.g. sulphuric acid, SO_4H_2O ; copper sulphate, $CuSO_4 \cdot 7OH_2$; chloral, $CCl_3CHO + OH_2$. In hydrates of the first type definite compounds are often formed in which the hydrogen of the water is partially replaced by other elements or groups, e.g. $Ca(OH)_2 \cdot (CaO + OH_2)$, callic hydrate. It would be convenient to restrict to such compounds the term *hydrates*, keeping hydrates for the other type of compound were it not that the distinction between the two classes is frequently impossible.

Hydra tuba, the name of the first stage after the egg in the development of some of the Hydrozoa.

(q.v.) of the subclass Acraspeda (q.v.). It is a small fixed hydra-like body, but with solid tentacles. By a series of transverse constrictions it is divided into a series of segments, each of which ultimately develops a series of lobes and breaks away from the parent; they then swim about as independent jelly-fish. This method of development occurs in the commonest English jelly-fish, *Aurelia aurita*. It is found in the *Rhizostomeæ* and many of the *Pelagiæ*.

Hydraulic Cements. [CEMENTS.]

Hydraulic Engine is a motor driven by water under pressure. The pressure-energy of the fluid is converted therein into the kinetic energy of the moving parts of the engine. In the case of waterwheels and turbines the water that enters the engine is possessed of a definite velocity; and impact occurring, there is a direct transfer of kinetic energy to the moving parts. Such cases do not, therefore, come exactly under the above definition of hydraulic engines, though the term is frequently employed inclusively. The ordinary engine worked by water pressure is similar in many respects to the steam-engine. A piston fits closely in a cylinder of cast-iron or cast-steel, and is forced backwards and forwards by water that is passed into the cylinder on one side or the other alternately. Since water is but slightly compressible, its expansion during portion of the stroke is not available, and it is necessary, therefore, to pass full-pressure water into the cylinder throughout the stroke, all of which is relieved of pressure during the return-stroke, deprived of its pressure energy, and passed into the exhaust. This inability of the working fluid to expand constitutes the important difference between such an engine and the ordinary steam-engine. Two, or preferably three, cylinders are used to drive the same crank-shaft, for hydraulic engines are not adapted for great speeds, and it is necessary to carry any one piston past its dead-points by means of another. When three are used they may be arranged radially at 120° to each other, the three piston-rods pointing to the centre of the crank-shaft, and moving in the same vertical plane.

Hydraulic Friction means the friction of water against water as contrasted with the friction of solid against solid. There are important points of difference in the two cases. Hydraulic friction is independent of the pressure; there is no more waste of energy in a foot-length of a water-main at one level than there is in an equal length of the same main at a higher level, and, therefore, lower pressure. This constitutes an important reason why force-pumps with great lifts may be made more efficient than those with small lifts, the former not requiring a proportionate amount of power to overcome the fluid friction in the pump and pipes. On the other hand, hydraulic friction is proportional to the speed for slow rates of motion, increasing with more than proportionate rapidity as the rate increases. [FRICTION, HYDRAULICS.]

Hydraulic Limestone [CEMENT-STONE.]

Hydraulic Press is a machine employed extensively for the compression of merchandise, various products in process of manufacture, and the like, for such purposes as the economy of space, the extraction of oil or other derivatives by the compression, or the improvement of the material under treatment. A thick cast-iron or steel hollow cylinder is fitted with a *ram* or cylindrical piece of metal that can slide freely into the hollow. When water is forced in under pressure, it presses on every portion of the ram that is open to the interior of the vessel, and the resultant force is one tending to drive the ram out. So that the ram shall be watertight, and yet move easily, Bramah introduced a collar of leather into a groove cut in the neck of the press. Water tending to pass outwards fills the collar and presses it against the ram, and so exit is prevented; the greater the water-pressure the more tightly will the collar cling to the ram. The characteristic property of a fluid—that it will transmit pressure equally in all directions—enables us to increase indefinitely the total available pressure of the ram, e.g. by doubling the sectional area of the ram the total liquid pressure thereon is doubled without increasing the pressure of the water, the larger dimensions of the press demanding, however, a greater quantity of pressure-water each stroke. [HYDRAULICS.]

Hydraulic Ram is an arrangement for raising water up to a high level by means of the fall of a larger quantity of water from a lower level. The mechanism, if self-acting, could not raise the whole of the available water to a greater height than that from which it is originally supplied, and thus only a certain fraction of the supply is elevated. Nevertheless, for small installations the mechanism is useful and fairly efficient, though for larger ones it is best to have a chain of converters consisting of main supply pipe, set of turbines, set of force pumps worked by the turbines, and delivery pipe to the higher level. [WATER SUPPLY.] The hydraulic ram has the main supply pipe leading to a low level. The flow of water through a special valve develops enough pressure to close the valve, and the momentum generated in the moving water causes it to force open another valve leading to an air-chamber. The momentum being neutralised, the second valve closes and the first opens. The air in the chamber is compressed by the inflow of water, and now that the valve is closed it reacts and forces the enclosed water up a delivery pipe to a higher level. The whole process repeats itself again, and so by an intermittent action a portion of the supply is elevated to a higher level than that from which it is derived.

Hydraulics is the general term for applied hydrodynamics. The chief applications of this science are either in the direction of water supply (q.v.) or of the utilisation or transformation of energy possessed by water under certain circumstances. In both these directions much has been done of late years, so much so that hydraulic engineering has separated itself from ordinary civil engineering, and now demands special training and experience. The question of the utilisation of

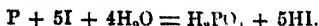
natural forces, as it is generally expressed, demands for its discussion an intimate knowledge of hydraulic principles; for the two best known instances are those of tides and of waterfalls, and in various parts of the world successful attempts have already been made to prevent entire waste of such energy. The practical machines dependent upon hydraulic principles are described separately. The chief of these are the *hydraulic press*, for producing a great intensity of pressure by means of a large bearing surface of water upon a ram enclosed in a suitable strong cylinder; the *water-wheel*, which is driven either by impact of running water or by the weight of water that is carried down in suitable buckets arranged round the circumference of the wheel; the *turbine*, which is the modern development of the water-wheel, and by stricter guidance of the descending water compels a greater percentage of its energy to be given to the wheel than before; the *pump*, *force-pump*, and *fire-engine*, for lifting water by a reciprocating motion of a piston in a cylinder; and the *centrifugal pump* for effecting the same result by a rotary motion of a water-wheel. Hydraulic presses are variously applied in the arts: for punching holes in metal plates, for riveting such plates together by squeezing wrought-iron rivets into shape after they have been dropped into the proper rivet holes, for working steel shears to cut metal, and the like. The well-known hydraulic lifts are precisely similar in principle, and are used extensively for domestic purposes, as well as for heavy work in engineering. Canal-locks are frequently worked now by hydraulic lifts; heavy guns are raised, lowered, or otherwise moved by the same means; and in large ship-building and repairing docks arrangements are made by which huge vessels are elevated on a series of powerful hydraulic lifts.

Hydrazines. Hydrazine (N_2H_4) is a remarkable compound, which has only been prepared within recent years by a complicated series of reactions. It is obtained united with water as the hydrate, $N_2H_4 \cdot OH_2$, a most reactive body, behaving as a strong base and neutralising acids to form salts, as e.g. $N_2H_4 \cdot H_2SO_4$. By replacement of the hydrogen by different groups of elements substituted hydrazines are obtained, many of which, e.g. *phenyl-hydrazine*, $C_6H_5N_2H_3$, are of exceedingly great importance, in chemical synthesis, and as reagents for the detection of certain classes of compounds.

Hydrides are compounds of hydrogen with some other element. In the case of the non-metals many hydrides of importance are known, but all are generally known by other names, as hydrochloric acid HCl , etc., so that the term *hydride* is chiefly restricted to the metallic compounds of hydrogen (copper hydride CuH_2 , sodium hydride Na_4H_2), of which many exist, but none of other than purely chemical interest.

Hydriodic Acid, a compound of composition HI . It may be formed by the direct union of its components in the presence of heated and finely-divided platinum. It is usually prepared, however,

by the joint action of phosphorus and iodine on water:



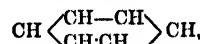
The pure substance is a colourless gas, with a suffocating smell, which can, by a pressure of 4 atmospheres at 0° , be converted to a liquid. It dissolves readily in water, forming an acid solution which, if exposed to air, slowly decomposes with formation of iodine. By replacement of the hydrogen of the acid salts the iodides (q.v.) are obtained.

Hydrobromic Acid (HBr) may be prepared by passing electric sparks through a mixture of bromine vapour and hydrogen. It is most readily obtained by the action of bromine upon phosphorus in presence of water:



It is a colourless gas, fuming strongly, and very irritating to the air passages and throat. It liquefies if cooled to -73° , and dissolves readily in water, forming an acid liquid which fumes in air, and possesses the irritating odour of the gas. The saturated solution contains 82 per cent. of HBr . The *bromides* are salts which are formed by the replacement of hydrogen by metals, and find many applications in medicine (bromide of potassium) and photography.

Hydrocarbons are, as their name indicates, compounds of the two elements carbon and hydrogen. These two elements may, however, be present in very diverse quantities, and to the extent of very many atoms in the molecule. Hence a large number of different hydrocarbons exist, the number being increased owing to the fact that compounds may have the same composition yet differ entirely owing to difference in the arrangements of the atoms in the molecule. They are divided into the *fatty* and *aromatic* hydrocarbons—the former being characterised by the arrangement of the carbon atoms in a straight chain, the latter by a ring constitution. Thus, as examples may be cited the two compounds *dipropargyl*, $CH \cdot C \cdot CH_2 \cdot CH_2 \cdot C \cdot CH$, and benzene



both of which have the formula C_6H_6 . They are also designated *saturated* or *unsaturated*, according to whether the number of hydrogen atoms in the molecule is as great as possible or not, this number in the fatty compounds being $2n + 2$, where n is the number of carbon atoms. They are formed in very diverse manners. Only one results from the direct union of carbon and hydrogen, viz. acetylene C_2H_2 . Large numbers occur in mineral oils as petroleum, while many are found among the distillation products of wood, coal, and other organic matters. A great many classes of synthetic reactions are also known by means of which the synthesis of hydrocarbons from less complex compounds can be effected. Amongst important or well-known examples of hydrocarbons may be cited *paraffin* and other waxes, *naphtha*, *petroleum*, *ozokerite*, *vaseline*, *benzene*, *naphthalene*, *marsh gas*, all of which may be referred to.

Hydrocephalus, an accumulation of fluid within the cavity of the skull, either in the ventricles of the brain or in what is known as the subarachnoid space. Acute hydrocephalus is caused by inflammation of the membranes which enclose the brain. [MENINGITIS.] Chronic hydrocephalus is usually a disease of intra-uterine life or of early childhood, and as it thus develops before the vault of the skull has become completely ossified, the accumulating fluid distends the yielding cranial bones and produces great deformity; the forehead protrudes, the eyes are pushed forwards, and the enlargement of the skull is in marked contrast to the emaciated face and puny frame of the affected subject. The mental condition of the child suffers, as might be expected, from the damage which results to the central nervous system, convulsions are not infrequent, and the child rarely lives more than two or three years. In some instances, however, the disease becomes arrested, and the patient may live to adult age. Little can be done in the way of treatment beyond the adoption of palliative measures, and the promotion of the general nutrition.

Hydrochloric Acid, also known as MURIATIC ACID and SPIRITS OF SALT, is a compound of the formula HCl , i.e. is composed of one part of hydrogen united with 35·5 parts of chlorine. It is a gas with a very pungent odour, which can be condensed by cold and pressure. It has been known since the 15th century. The ordinary acid of commerce is, however, not the pure acid but its solution in water, in which it is very soluble, 1 volume of water absorbing over 500 volumes of the gas at 0° . The solution fumes in the air, and has a specific gravity of 1·22 if concentrated, but becomes weaker on boiling until a 20 per cent. solution is obtained, which then boils unchanged. Commercial acid is frequently of a yellow colour, due to the presence of impurities, usually iron. The gas may be obtained by the direct union of hydrogen and chlorine on exposure to sunlight, but is always prepared and manufactured by the action of sulphuric acid upon common salt, and hence results as a bye product in the manufacture of soda. [LEBLANC PROCESS.] The following equation represents the change:



The salts obtained by replacing the hydrogen by a metal are termed chlorides (q.v.), and many are of great importance from chemical, domestic, and industrial points of view, while the acid itself is also much used in manufacturing and purely chemical operations.

Hydrocinnamic Acid, a compound of the formula $C_6H_5CH_2CH_2CO_2H$, being β phenyl propionic acid. It forms needle-like crystals, melting at 47° and soluble in hot water and alcohol. It may be prepared by many synthetic reactions, and is a product of the decay of nitrogenous matter such as brain, albumen, etc.

Hydrocoele, the occurrence of fluid effusion in the serous sac which envelopes the testis.

Treatment usually consists in tapping the sac and evacuating the contained fluid.

Hydrocorallina, a group of Hydroids (q.v.) including those in which the skeleton is massive and calcareous, and which have generally been included among the Anthozoa. They are divided into two groups, the Millepores, and the Styasters. The former form massive or lobed or flat expanded skeletons, through which run a double series of tubes; one set is large, and one small. The large tubes are intercepted by horizontal plates or tabulae. These tubes are occupied by large "gastrozooids" or digestive polyps, while the smaller ones which surround them are occupied by "dactylozooids." These have no mouth, and simply serve to capture food, which is digested by the gastrozooids, which supply it to the colony by means of a series of canals. The dactylozooids may be irregularly scattered or placed in definite circles around the gastrozooids. The Styasters form branching plant-like colonies, on the surfaces of which open a number of apertures on raised areas. The pores are broken up by septa, which radiate from the walls towards the centre. These, however, are not true septa. In addition to the large gastrozooids, there are numerous smaller ones (dactylozooids) arranged around each of the former, the whole group forming a cyclosystem. The reproductive organs are external, and are developed in sac-like "ampulla." This also affords clear evidence of the Hydrozoan affinities of these corals. The Millepores are generally colourless or pale yellow, but the Styasters are a fine red tint.

Hydrocyanic Acid. [PRUSSIC ACID.]

Hydrodynamics, the science of the force-relations of water and other liquids. Usually it is restricted to such relations that produce motion of the fluid. When equilibrium is the result the division of Hydrostatics (q.v.) is entered. The theoretical study of hydrodynamics is not simple, but a knowledge of a few leading principles is often enough to solve many problems of practical importance. The most important principle is that of continuity. If in mass of liquid any imaginary volume be taken, the amount of liquid that flows into this volume during any time must be equal to the amount that flows out; for liquids are practically incompressible, and as much remains in the enclosure at the end of the interval as existed therein at the beginning. The same principle is extended to all fluids, including both gases and liquids, but here it must be modified if the density of the enclosed fluid has altered during the interval. This principle helps us at once to determine the speed of a stream across a given section when its speed at another given section is known. The great theorem connecting the varying pressure, speed, and level of a given quantity of water in a stream-line is due to Bernouilli, and has far-reaching applications in the design of turbines, centrifugal pumps, and other machines. It states that any such small quantity of water at any instant during its flow possesses a definite pressure p , density ρ , height h (reckoned from the free surface level), and

speed v . These will vary in such a way that the sum of the terms

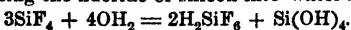
$$\frac{p}{\rho} + gh + \frac{1}{2}v^2$$

will always remain constant, g representing the intensity of gravity. The first term is sometimes called the pressure-energy term, the second is a measure of the potential energy, and the third of the kinetic energy of the quantity of water taken. One deduction from this theorem is that the speed of flow from a small orifice in the side of a vessel containing liquid is the same as if the liquid fell from the free surface level down to the orifice. If h is the vertical distance between these two levels, the speed v would be $\sqrt{2gh}$, g being, as before, the intensity of gravity. This is known as *Torricelli's Theorem*.

Hydro-Electric Machine is a machine invented by Sir William Armstrong for the separation of opposite electricities on a large scale. Steam is generated in a boiler, and is made to blow through specially-shaped orifices of wood against a series of points arranged in front. In this simple way, analogous to the rubbing of dissimilar substances (such as glass and silk), the separation is effected, and very great differences of potential produced on the collectors. [ELECTRICITY.]

Hydrofluoric Acid (HF). Pure hydrofluoric acid is a colourless liquid, which is obtained by heating the acid fluoride of potassium KHF_2 . The preparation must be performed in a platinum retort owing to the highly corrosive action of the acid, and is attended with considerable danger, as the fumes of the acid attack the throat, and at least one death has occurred through the inhalation of the vapour. It boils at 19°C , and has a specific gravity of about 0.99 . A dilute acid is obtained readily by the action of sulphuric acid upon fluorspar CaF_2 , in lead or platinum vessels. This aqueous acid attacks metals, forming salts known as fluorides (q.v.); gold, lead, platinum, however, resist its action. It may therefore be kept in vessels of these substances, but caoutchouc bottles are more convenient for this purpose. It attacks glass, forming a fluoride of silicon (SiF_4) and water, and is hence used for etching glass, etc.; it cannot for this reason be kept in ordinary bottles. All operations involving the use even of the aqueous acid should be conducted with great care, as it evolves poisonous vapour, and produces very painful blisters on the skin. [FLUORINE.]

Hydrofluosilicic Acid, an acid of composition H_2SiF_6 , which is obtained in aqueous solution by passing the fluoride of silicon into water:



It thus forms a colourless, fuming acid liquid, which finds its chief use in *qualitative analysis*, being used as for the separation of barium from strontium salt, and as a reagent for potassium salts.

Hydrogen ($H = 1$). Although hydrogen was known in the 16th century, being first described by the chemist Paracelsus, its nature as an elementary substance was not demonstrated until the researches

of Cavendish in 1766. The same chemist also showed that water is produced when the inflammable air, as he termed hydrogen, burns either in air or in oxygen. It occurs in the free state to only a small extent upon the earth, being found in volcanic emanations, in the gases from oil-wells, and as a product of the decay of animal matter. In combination, however, it is found to a very large extent, forming one-ninth the weight of water, and being a constituent of most organic substances and of all acids. The sun is completely surrounded by an atmosphere of hydrogen, the presence of which has also been demonstrated in many stars. It may be prepared by the decomposition of water by means of an electric current. It is most conveniently obtained by the action of certain metals upon acids, zinc and sulphuric acid being suitable:



numerous other methods also can be employed. It is a colourless gas, possessing neither taste nor odour, and is the lightest body known, its density being about 0.07 that of air. It is only slightly soluble in water, 100 volumes of this liquid absorbing about two volumes of the gas. It is the most difficult of all gases to liquefy, and it was not until 1899 that its liquefaction was satisfactorily accomplished. Certain metals possess the power of condensing hydrogen within their substance—*occluded hydrogen*—the gas being again evolved on heating. Palladium absorbs in this manner 900 times its volume of hydrogen; the resulting alloy was called *hydrogenium* by Graham. Iron also can similarly absorb the gas, which is hence frequently found in meteoric iron. With the halogens (q.v.) it forms acids uniting directly with *fluorine* even in the dark, and with chlorine if exposed to sunlight. In many of its characteristics it shows resemblances to the metals. It has the least atomic weight of all the elements, and on that account forms the unit in terms of which the atomic weights are expressed. In air hydrogen burns with a pale blue flame, and mixed with oxygen it forms a mixture which explodes violently on application of a light. A mixed jet of hydrogen and oxygen burns with very intense heat, and is used for the production of high temperatures, and largely for limelight, these forming the chief applications of hydrogen for technical purposes. It is, however, sometimes employed for filling balloons, and in the chemical laboratory finds frequent usage as a reducing agent.

Hydrogen Peroxide, a compound represented by the formula H_2O_2 , consisting therefore of the same elements as water, but with double the amount of oxygen in the molecule. It may be prepared by adding barium peroxide in small quantities to dilute hydrochloric acid:



The solution thus obtained is concentrated as far as possible under the air-pump, until a syrupy colourless liquid results (specific gravity 1.45). The solution, however, readily loses oxygen, but is more stable if dilute. It acts as a strong oxidiser, converting many elements (such as chromium) into

their oxides, the peroxide itself being reduced to water. Some metals (as silver), however, when finely divided act on the liquid, and liberate oxygen without undergoing any change themselves [CATALYSIS], and in some reactions it reduces oxides thus :



It finds many technical applications; thus, owing to its power of converting black sulphide of lead into white sulphate, it is used for renovating pictures in which the pigment white lead has become blackened. A solution is also employed as a hair-wash to give a golden shade, and for the purpose of bleaching when other substances might be injurious, e.g. with feathers, ivory, etc. It has been used in medicine as a disinfectant, and as an antiseptic or "germicide." In the laboratory it is largely used in various analytical processes.

Hydroids, an order of Craspedote Hydrozoa (q.v.), including those in which the body is small, is usually fixed by an adherent base, and has a ring of tentacles around the mouth: they are rarely simple (e.g. *Hydra*) but are usually colonial. They are nearly all marine, but *Hydra* is fresh-water, and *Cordylophora* (q.v.) has acclimatised itself to fresh or but slightly brackish water during the present century. The order is divided into three sub-orders: (1) the Eleutheroblastica, including the fresh-water *Hydra* and one or two doubtful genera; (2) the Gymnoblastica, in which the general colony (hydrosoma) is protected by a chitinous skeleton or "polypary," which does not, however, protect the polyps or individuals (*Cordylophora* (q.v.) is a very good type of this group); (3) Calyptoblastica or Thecaphora, in which the polyps are protected by expansions of the skeleton into hydrothecae or cups; these may be "sessile," being attached to the main tube as in *Sertularia*, or pedunculate, being borne on long stalks as in *Campanularia*; (4) Hydrocorallinae (q.v.), including those which form a massive calcareous skeleton.

Hydrometer is an instrument for the determination of the density of a substance. Most hydrometers are for the determination of liquid densities, and many of them have special names. Thus a *lactometer* is a hydrometer to test milk by observation of its density, a *salinometer* is for salt water, a *saccharometer* for solutions of sugar, and an *oleometer* for oils. The ordinary hydrometer is very simple. It consists of a glass float with a thin graduated stem. It floats with the stem vertical by reason of a small enclosed quantity of mercury at the lower end. In light liquids the greater portion of the stem is immersed, but in heavier liquids the instrument rises, and less of the stem is immersed. By proper graduations on the stem, the liquid level may give direct readings of the density of the liquid in which the instrument is made to float. Nicholson's hydrometer or *areometer* is on the same principle, but is arranged for the determination of the densities of solids. The instrument is usually of metal; it is much larger, and only one mark is necessary on the stem. There is a cup

supported at the top, and another at the bottom of the instrument, for the estimation of the weight of the solid in air and in water respectively. These two weights are sufficient to determine the density required. [HYDROSTATICS.]

Hydromys, a genus of water-mice, with five species, the type of a sub-family (*Hydromyina*) from the Australian region. The molars are only two on each side in each jaw. They live near water, and the hind-feet are partially webbed.

Hydrophilous, a term, rarely required in vegetable physiology, used with reference to the few cases, such as that of *Vallisneria* (q.v.), in which cross-pollination is effected by the agency of water.

Hydrophis. [SEA-SNAKE.]

Hydrophobia (RABIES), a disease of the canine tribe which sometimes affects man. When it occurs in the human subject it is usually the result of the bite of a rabid dog; symptoms do not, as a rule, appear until the lapse of several weeks (sometimes months), after the injury. There is usually some pain at the site of the wound, the patient becomes feverish, and after a while the characteristic symptom, disinclination to swallow fluids, becomes developed; the patient becomes excited, his condition resembling that of acute mania; the throat is inflamed, and repeated attempts to expectorate the viscid saliva which exudes into the mouth are made. Any attempt to swallow produces a spasm of the muscles concerned in that action, or even general convulsions, the pulse becomes quick, the patient feebler, and the disease terminates in death in two or three days. M. Pasteur succeeded in protecting animals from rabies by preventive inoculation. By injecting the virus into rabbits, then subsequently removing their spinal cords and drying these, he succeeded in obtaining a mitigated poison; the longer the spinal cord is dried, the less virulent it becomes. Such weakened material is found to possess the power of protecting an animal against the effects of inoculation with the more virulent poison. Pasteur achieved considerable success in applying this method to the treatment of persons who have been bitten by rabid dogs.

Hydroquinone possesses the formula $\text{C}_6\text{H}_4(\text{OH})_2$, being what is chemically known as *parahydroxyl benzene*. It is best obtained by reducing *quinone* (q.v.) by sulphurous acid. It forms monoclinic or hexagonal crystals, which melt at 169°, and is readily soluble in water, the solution being coloured brown by ammonia. Of late years hydroquinone has grown in importance owing to its introduction by Captain Abney as a photographic developer. [PHOTOGRAPHY.] For this purpose it possesses the advantage of cleanliness, keeping clear and colourless during development, while the image formed by the silver deposit is of an exceedingly good colour. It is generally used in a solution of 1 or 2 grains to the ounce, with the addition of a dilute solution of ammonia, sodium hydrate or sodium carbonate; different formulæ being recommended by the different plate-makers.

Hydrostatic Bellows, an arrangement on the same principle as the hydraulic press, by which a heavy weight distributed over a large area may be lifted by the pressure of water produced in a small vertical pipe. The weight is supported on a large board that forms the cover of an ordinary bellows. As water is poured down the small pipe the bellows gradually dilate and the weight is lifted.

Hydrostatic Paradox, the old name given to the multiplication of force by transmission through liquid. The intensity is unaltered, but if the bearing surface is increased the total value of the force on that surface is proportionately increased. If motion is produced by the action of the greater force, there will be no multiplication of the available energy by transmission through the liquid; what is gained in force is lost in distance traversed, as in the analogous case of the simple lever.

Hydrostatics, the science of the force-relations of liquids in equilibrium. A liquid has no rigidity—that is to say, it may change its *shape* under the action of extremely small forces. This absence of rigidity may be difficult to observe in some cases, owing to the *viscosity* of the liquids taken. Nevertheless, with all liquids small forces can produce indefinite distortion, although in the case of viscous liquids much time may be required for the effect to be rendered visible. Water, ether, and alcohol are examples of mobile liquids; pitch and sealing-wax are examples of very viscous liquids. A stick of sealing-wax supported horizontally at its extremities will in the course of weeks become so curved that it falls from its supports. A tallow candle if similarly supported will at once manifest a certain amount of curvature, but will not become further bent. The sealing-wax is called a hard liquid; the candle is a soft solid. The resistance of a liquid to diminution of bulk is very great, like that of a solid. The compressibility of water, for example, is so slight that for a long time water was thought incompressible. [CAVENDISH EXPERIMENT.] This characteristic distinguishes liquids from gases, which possess great elasticity (*i.e.* they change their *volume* readily under the action of very small forces) as well as no rigidity. If a mass of liquid be at rest its pressure at any point on any surface must be at right angles to that surface, otherwise the oblique pressure of a non-rigid substance would produce motion. Hence it may be shown that at any point the pressure is the same in all directions, and an ordinary definition of a liquid at once follows, which assigns to such a substance that characteristic property. If therefore a pressure of a definite intensity per square inch be imposed at one spot on an enclosed volume of liquid, that pressure will be transmitted in all directions through the liquid, and every portion of its boundary will feel the same intensity of pressure. This is the principle of the hydraulic press, and the explanation of the hydrostatic paradox (q.v.).

When a solid body is entirely immersed in water (this liquid is taken as an example) every portion of its surface is acted upon by a normal pressure.

An infinite number of forces thus exist, and we know that their resultant is an upward force equal to the weight of the water displaced, for before the body was introduced the water subsequently displaced was just supported by the same set of forces. Hence the foreign substance is acted upon downwards by its own weight and upwards by the weight of water displaced. If it has the same density (q.v.) as water these two forces balance, and the body remains in position without the application of other forces. If its own weight preponderates its density is said to be greater than unity, and it shows a tendency to sink. If the water displaced has the greater weight its density is less than unity, and it tends to rise to the surface. If this tendency is permitted it will assume a floating position such that the weight of the water displaced in that position is now equal to the weight of the substance itself.

Further, it then assumes a position such that its centre of gravity and that of the water displaced are in the same vertical line, otherwise from statical considerations there could be no equilibrium. The density of a substance, or relative mass of the substance compared with an equal volume of water, is calculable when we know its weight in air and in water. The difference between its weight in air and in a vacuum is generally neglected. It is then only necessary to divide the weight in air by the loss of weight in water. If it float in water, the weight of water displaced by the whole volume is determined by attaching a heavy substance to it, such that the combination will sink. The whole is then estimated as one body and a deduction made for the heavy substance.

The free surface level of a liquid at rest must be horizontal. For a spherical particle at the surface is acted upon by its own weight and by a hemisphere of fluid. The former is a vertical force, and the resultant of the latter must therefore also be vertical. This could not be unless the surface were at right angles to the vertical.

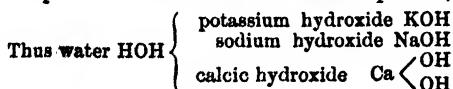
The pressure at any depth in a liquid is that due to the vertical height of liquid above. It may be that the base of the vessel is greater or less in area than the surface of the liquid; the total pressure on the base will be independent of such variety if the depth of liquid remains constant. Thus clear distinction must be made between the weight of the liquid and the total pressure of liquid on the base of the vessel.

Hydrothorax, an accumulation of fluid in the pleural cavity.

Hydrotropism, curvature expressing unequal growth (heterauxesis) induced by the proximity of moisture. *Positive hydrotropism* is curvature towards the moisture; *negative hydrotropism*, curvature away from it. If, for example, the roots from germinating seeds grow [under the influence of geotropism (q.v.)] through holes in the bottom of a box soaked with moisture, they will bend backward, especially if the air be dry, towards the moist wood. This is *positive*. The rarer negative curvature is exhibited by the sporangiferous hyphae of the

fungus *Phycomyces*. The term hydrotropism was originally suggested by Darwin.

Hydroxides are compounds which may be regarded as derived from water by the partial replacement of its hydrogen, but the replacement may extend over several molecules. This is seen by the inspection of the formulæ of these compounds;



The metallic hydroxides mostly exhibit basic properties, those of sodium and the allied metals being strongly alkaline. [HYDRATES.]

Hydroxyl is the name given to the group of elements OH which exists combined in hydroxides, alcohols, and many other classes of compounds.

Hydroxylamine, or OXYAMMONIA, a compound of composition NH_2OH usually prepared by action of hydrogen upon a nitrite or nitrate, the hydrogen being generated in the vessel containing the compound. Its solution is a strongly basic substance, which combines with acids to form salts. It possesses strong reducing properties, and has been used as a photographic developer. The pure substance has been prepared only within very recent years, and is a strongly reactive and readily explosive crystalline solid.

Hydrozoa, one of the two classes of the Phylum Coelenterata (q.v.). It is separated from the Anthozoa (q.v.) by the fact that the digestive cavity is not separate from the general body cavity, into which the mouth at once opens. The generative products, moreover, are usually discharged to the exterior and not into the body cavity and thus out by the mouth or special pore. Very commonly they are dimorphic, or possess two distinct forms; thus the common hydroid colony *Millepora* has two quite dissimilar sets of zooids; this is still better shown in the Siphonophora (q.v.), in which the individual polypites are modified to serve very different functions; thus some are reproductive, others nutritive, others protective, and others locomotory. Alternation of generations (q.v.) is also common; a fixed colony often gives rise to free-swimming jelly-fish in which the reproductive organs are developed. The gastric cavity or stomach is simple in structure, but a series of four ridges may run along it, and thus increase the digestive surface. The Hydra is the simplest type of the Hydrozoa, but this is probably the result of degeneration rather than of having retained the primitive characters of the order. The Hydrozoa mostly have a soft chitinous skeleton, as e.g. in *Sertularia* (the Sea-fir), but it may be massive and calcareous as in the *Millepora*. The group is divided into two subclasses:—

- I. CRASPEDOTA. Order 1. Trachymeduse (q.v.).
2. Hydroida (q.v.).
3. Siphonophora (q.v.).

- II. ACRASPEDA.
1. Tetrameralia.
2. Octomeralia.

Hyères, a town and commune of France, in the department of Var and the arrondissement of

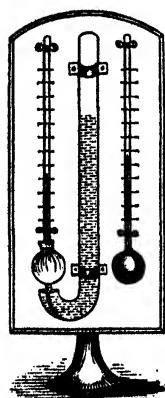
Toulon. The town is 3 miles from the coast of the Mediterranean, lat. $43^{\circ} 7' N.$, and long. $6^{\circ} 7' E.$, on the S.E. slope of a hill. The neighbouring market-gardens are famous for early fruit and vegetables and for winter roses. Orange-flower water is the chief product of the town.

Hygiene. The study of the means of preventing disease and prolonging life is one which dates from very early times. The extent to which inquiry had been pushed at a very early period in this matter is seen on a study of the Book of Leviticus, and, with regard to the Greeks, evidence of a like kind is to hand in the writings of Hippocrates. During the Middle Ages but scant attention was paid to the subject of preventive medicine, and the formidable epidemics which raged in Europe until as late as the seventeenth century, were no doubt attributable in the main to the neglect of this study. Attention came at length to be directed to the evils attendant upon overcrowding, want of cleanliness, and the like, and the great discovery of vaccination at the end of the 18th century opened up the prospect of further development in disease prevention. In the nineteenth century considerable progress was made. The Vaccination Acts have been the means of affording to large masses of the population protection from a most formidable disease; the Factory Acts have done much to ameliorate the condition of workers; and the various Public Health Acts have caused the undertaking of schemes for the supply of pure water, for the disposal of excreta, and have resulted in the abatement of many nuisances. With the growth of the system of registration of deaths, light has been thrown upon the distribution of disease, and the later development of the practice of notifying infectious disease will, no doubt, be productive of increased knowledge and improved means of combating the progress of epidemics. The recognition of the evil effects of breathing a confined and vitiated atmosphere, the demonstration of the relationship of such disease as consumption to dampness of soil, the spread of cholera and typhoid by contaminated water supplies, the connection between food and epidemics (as, for instance, in scarlatina and diphtheria epidemics traceable to milk supplies), and the relation between the diseases of animals and of man—on these and on other matters the study of hygiene has, during the last fifty years, thrown much light. The study has already resulted in a material reduction in the death-rate.

Hygrometer, an instrument intended for the measurement of the amount of moisture in the air. [HYGROMETRY.]

Hygrometry is that branch of physics which deals with the moisture contained in the atmosphere. It involves a knowledge of the principles of heat, and is generally studied with the questions of evaporation and condensation. The greatest amount of water vapour that can be contained in a cubic foot of air will depend upon the temperature. For every temperature there is a definite maximum pressure producible by the water-vapour, this pressure increasing with the temperature. Thus,

as the air gets hotter, it becomes able to contain further quantities of vapour without deposition. It is not usual for the air to contain as much vapour as it can hold under its given conditions of temperature. The fraction of this maximum that is actually present is called the *relative humidity*. This evidently increases as the temperature falls, without change of the absolute quantity of vapour per cubic foot, until a temperature is reached when the air cannot become cooler without condensation of vapour taking place. At this critical temperature, called the *dew-point*, the air is saturated with water-vapour, and its relative humidity is unity. [DEW.] The dew-point cannot be higher than the actual temperature of the air without danger of condensation occurring with great violence. Such a state of things is rare; it is only possible when the atmosphere is very pure and free from dust or other nuclei that act as centres of formation of water-drops. Instruments for determining the dew-point are simple in construction. They are arranged to cool down the air by application of cold water or by evaporation of some such volatile liquid as ether. In this way the air is brought to a temperature below the dew-point, and deposition of dew results. With a sensitive thermometer the exact temperature of deposition is obtained. Hygrometers working in the above way are direct-reading. The best are due to Regnault and to Dines. A pair of thermometers, the bulb of one of



THE WET AND DRY BULB HYGROMETER.

which is kept continually moist by being surrounded with a moist wick, constitute the Wet and Dry Bulb Hygrometer. The wet bulb thermometer records a lower temperature than the other, unless the air is saturated, on account of continual evaporation from its surface. From the two observed temperatures the dew-point may be calculated. Hygroscopes merely exhibit the presence of moisture in the air. They generally consist of some substance capable of readily absorbing moisture whose elastic properties are modified thereby and rendered easily visible. The type is illustrated by Saussure's hair hygrometer, in which a length of hair varies with the degree of moisture of the surrounding air.

Hymen, or **HYMENÆUS**, in classical mythology the god of marriage, a personification of the bridal song. The various legends agree that he was a beautiful youth. In art his attribute is a (nuptial) torch.

Hymenocaris, an extinct genus of Phyllopoda (q.v.) found in the Skiddaw slates and other rocks of the Ordovician period. It is of interest as the earliest known genus of the Phyllopoda.

Hymenomycetes, an order of fungi (q.v.)

belonging to the sub-class Basidiomycetes (q.v.) and including the mushroom (q.v.) and most of the other plants to which the name fungi is popularly applied. They have generally a loosely-branched filamentous *mycelium* or "spawn," in the soil or other nidus on which they may grow, such as the stem of a tree, but the mycelium may be compacted into a *sclerotium* or into elongated strap-like strands, known in *Agaricus melleus* as *rhizomorphs*, which ramify under the bark of pine-trees. From the mycelium rises the compound *sporophore* or *hymenophore*, which is generally a *pileus* or umbrella-like body on stalk or *stipes*. In some, the entire sporophore is at first enclosed in a membrane, the *volva* or *velum universale*; in others, a membrane, the *velum partiale*, encloses the lower surface of the pileus, and on bursting is represented by a torn ring or *annulus* round the stipes. In *Amanita* (q.v.) both membranes are present. Through the sporophores of some forms, especially of *Lactarius*, hyphae secreting an abundant milky, but generally acrid, juice extend. The *hymenium*, or spore-bearing surface, is generally on the under side of the pileus. It is variously disposed, being smooth in the *Auricularini*, on radiating *lamellæ* or "gills" in the *Agaricæ* (q.v.), lining tubes or "pores" in the *Polypori*, and covering dependent spine-like bodies in *Hydnæ*. It is made up of rows of club-shaped cells, some of which, known as *paraphyses*, are barren, others, known as *cystidia* (though also barren), of relatively greater size, and others, the *basidia*, ending in the points known as *sterigmata*, mostly four on each basidium, from which the spores, hence called *sterigmatospores* or *basidiospores*, are formed and abstricted. The Hymenomycetes thus differ from the Gasteromycetes (q.v.) in having the hymenium exposed to the air (*angiocarpous*) before the spores are ripe. There are no known sexual organs in these plants. The order is represented in all quarters of the globe, and comprises nearly all the fungi which are of value as food. It is not represented in a fossil state, except in Pleistocene peat.

Hymenoptera (membranous-winged), an order of insects including the ants, bees, wasps, saw-flies, gall-flies, ichneumon flies, etc (q.v.). The main character of the order is the possession of an ovipositor on the end of the abdomen of the female. It is developed either as a saw (*serra*), a sting (*aeuleus*), or a boring organ (*terebra*). By means of this the eggs are deposited in a suitable place for development as in the leaves of plants (gall-flies), or in other insects (ichneumon flies). In some, e.g. the wasps, it is a defensive organ.

Hymn, in Greek literature a song in praise of gods or heroes, sometimes, like the Homeric hymns, in epic metre, but more usually in lyric. A Christian hymn is defined by St. Augustine as "praise to God with song." At a later date hymns varied considerably in purpose and character, and the word acquired a more extended meaning, so as to include a prayer or any expression of devotional feeling in a metrical or rhythmical form.

The hymnody of the early Church was based on that of the Jews. The practice of singing hymns is first mentioned in the Gospels. There is nothing to show whether these hymns were or were not the Psalms of David. On the other hand the canticles, *Magnificat*, *Benedictus*, etc., are closely modelled on the sacred poetry of the Hebrews. Many of the hymns and poems of the early Greek Church—e.g. those of Gregory Nazianzen (330-89)—are in classical metres. But at the same time the use of the Jewish Psalter and of the "Hallelujah" and "Hosanna," as well as the character of the versicles and antiphons, shows that Christian worship was influenced by Jewish traditions. The *Gloria in Excelsis*, *Gloria Patri*, *Te Deum*, and other doxologies composed during this period are rhythmical but non-metrical hymns based on passages of Scripture. There seems to have been a prejudice against the use of hymns in the services of the Church, which lasted till the fifth century or later, but it was afterwards found that they could be made a vehicle for impressing orthodox dogmas on the minds of the people, and thus preventing the progress of heresy. After the final separation of the Eastern and Western Churches the number of hymns in the former greatly increased. Amongst the writers of Greek hymns may be mentioned St. Andrew, Archbishop of Crete (660-c. 732), whose "Christian, dost thou see them?" was, like many other early hymns, translated by Dr. J. M. Neale, and Joseph the Hymnographer (d. 883). The earliest Latin hymnographers were St. Hilary of Poitiers (d. 368) and St. Ambrose of Milan (c. 340-397). Of the many hymns attributed to the latter about a dozen are considered genuine. Perhaps the most famous name in the following centuries is that of Gregory the Great (540-604). The processional hymn, *Gloria, Laus, et Honor* ("All glory, laud, and honour"), sung on Palm Sunday, was written by St. Theodulphe of Orleans (d. 821). *Veni Creator Spiritus* ("Come, Holy Ghost, our souls inspire") is attributed to Rabanus Maurus, poet to Charlemagne. A great impulse was given to hymn-writing by Notker (c. 840-912), a Benedictine monk of St. Gall, who introduced the sequence or prosa, a rhythmical but non-metrical composition, between the reading of the Epistle and Gospel. Sequences afterwards assumed a metrical form, and thus became identical with hymns in the narrower sense. The greatest writer of mediæval hymns and sequences was Adam de St. Victor (d. c. 1180), who founded the Victorine school. But no individual hymns are more celebrated than the *Dies Irae* ("Day of wrath, O day of mourning") by Thomas of Celano, the friend of St. Francis of Assisi, and the *Sabat Mater* of Jacobus de Benedictis (or Jacopone da Todi) (d. 1306).

Soon after the Reformation the liturgical use of hymns was discontinued in the English Church. Seven hymns translated from the Latin, one for each of the hours of prayer, were given a place in King Henry's Primer (1545), but they did not reappear in that of King Edward. Their place was taken by Sternhold and Hopkins' metrical version of the Psalms (1561), which in 1696 gave way to

that of Tate and Brady. Many hymns were, indeed, written during the Elizabethan period, and the sacred poets of the first half of the seventeenth century—especially Wither, Donne, George Herbert, Henry Vaughan, and Richard Crashaw—occupy a high place in English literature, but all attempts to introduce hymns into public worship were unsuccessful. Three names stand out with some prominence in the generally barren period which now intervenes until the Wesleyan revival—viz. Bishop Ken (1637-1710), whose beautiful Morning and Evening Hymns are still the most popular sacred poems in the English language, and the Dissenting ministers Isaac Watts (1674-1748) and Philip Doddridge (1702-51). The Methodist movement, with its deep personal religion, led to a great revival of hymn-writing, and during the last half of the eighteenth century some twenty hymn-books were published, generally strongly Calvinistic in tone, which came into use in Evangelical and Nonconformist places of worship. The chief hymn-writers of this school were Charles Wesley (1707-88), who wrote "Jesus, Lover of my Soul," and many other favourite hymns, and A. M. Toplady (1740-78), author of the well-known "Rock of Ages." Amongst the *Olney Hymns* by Cowper and John Newton, there are a few—such as "Hark, my soul," "Sometimes a light surprise," and "God moves in a mysterious way"—which are worthy to rank with these. During the first quarter of the nineteenth century there was a great increase in the number of hymn-books for public worship, all of them distinctly Evangelical or Nonconformist in tone. The publication in 1827 of Heber's *Hymns*, followed soon afterwards by the works of H. F. Lyte and Charlotte Elliott, did much to revive the interest in hymnody, and the movement thus instituted resulted in a general endeavour to raise the standard of the hymns used in the services of the Church. It culminated in 1861 with the publication of *Hymns Ancient and Modern*, a collection which, with a great deal of indifferent work, contains most of the good hymns, representing many shades of religious opinion.

Ever since the days of Luther, whose stirring hymn, *Ein feste Burg ist Unser Gott* was sung by the soldiers of Gustavus Adolphus at the battle of Lutzen, Germany has, before all other countries, been the home of religious poetry. Among the more recent German hymn-writers mention may be made of Novalis, Fouqué, Arndt, the Krummachers, and Spitta. In the Reformed Church of France metrical versions of the Psalms by Marot, Beza, and Corrart were successively employed in public worship from the sixteenth to the eighteenth century, but, as in England, they were finally superseded by hymns.

Hyoid Bone is the bone situated in the neck between the root of the tongue and the upper part of the larynx.

Hyopotamus, an extinct genus of swine-like animals with short canines, comprising several species, found, in rocks of Oligocene and Miocene age, at Hempstead in the Isle of Wight, in France, Switzerland, Dakota, and the Siwalik Hills in India.

The species from the two last-named localities reach a very large size.

Hyoscyamine, an alkaloid occurring in the seeds of certain plants, *e.g.* *Hyoscyamus niger*, Henbane, *Atropa belladonna*, etc., from which sources the substance may be obtained. It possesses the composition represented by the formula $C_7H_{12}NO_3$, and crystallises in soluble needles melting at 108° C. To this compound, and another of similar composition, *Hyoscine*, the poisonous and medicinal properties of Henbane appear to be due. In many respects it closely resembles *atropine* (q.v.), which is also represented by the same formula.

Hyoscyamus. [HENBANE.]

Hypatia of Alexandria, daughter and pupil of the philosopher Theon, was said to have been the head of the Neoplatonic school of Plotinus. At any rate her learning, virtue, and beauty drew numbers to her lectures. As an ardent opponent of Christianity, and suspected of influencing the prefect of Alexandria against Cyril, the archbishop, she became hateful to the monks, and was dragged by a rabble of them from a street into a church and torn to pieces (415). She is the subject of a historical novel by Charles Kingsley.

Hyperesthesia, the condition of increased susceptibility to external impressions induced in some forms of disease of the central nervous system.

Hyperbola, in geometry, is one of the conic sections. It is the curve produced by the section of an ordinary right circular cone at any angle to the axis less than that at which the slant edges of the cone cut the axis. Its definition in analytical geometry is that it is the curve every point on which is at a distance from a given point that is a constant multiple of its distance from a given straight line, this multiple being greater than unity. The curve has two identical branches, and extends to infinity in two directions. It has two axes of perfect symmetry, their intersection therefore constituting the *centre* of the hyperbola. The above-mentioned fixed point and fixed line in the definition are called the *focus* and the *directrix* respectively. In every hyperbola there are two foci and two directrices, a pair of each, either of which pairs may be employed to develop the curve. The centre (q.v.) of the hyperbola differs from that of a circle or an ellipse in that tangents may be drawn from it to the curve. Nevertheless, these tangents only touch the curve at infinite distance; they lie in two lines symmetrically arranged about the axes, and are called *asymptotes* (q.v. see figure). The fundamental metrical property of the hyperbola may be shown to have the following rendering: the product of the distances of any point on the curve to the two asymptotes, when the distances are measured parallel to these two lines, will be always the same.

Hyperbolic Logarithms. [LOGARITHMS.]

Hyperides (about 385-322 B.C.), one of the ten Attic orators, a pupil of Isocrates and generally a political supporter of Demosthenes in his struggles against Macedonian ascendancy. He was son of Glaucippus, an aristocratic member of the *Aegeid* tribe, and of the deme Collytus. He soon rose to eminence as a composer of speeches for the law courts, and in 380 B.C. conducted the impeachment of the general Autocles for treason. In 324 B.C., when Harpalus deserted Alexander and endeavoured to incite Athens to a war of liberation, Hyperides was one of the patriots whom the traitor won over, while Demosthenes, seeing that war was hopeless, had Harpalus imprisoned and his treasure seized. On the escape of Harpalus and the implication of Demosthenes in the alleged disappearance of half the treasure, Hyperides was one of the ten prosecutors who procured the condemnation of Demosthenes. But on Alexander's death (323 B.C.) the two patriotic orators were again united in opposition to Antipater and Craterus. Hyperides was mainly responsible for the Samian War, which ended in the disaster of Crannon (322 B.C.). On the demand of the victorious Antipater, Hyperides, with Demosthenes and others, was condemned to death. He fled to *Ægina*, and thence to Hermione. He was dragged from the temple of Demeter by Antipater's adherents, sent to Athens, and there put to death. The style of his oratory presents an effective mixture of richness and simplicity, of elaboration and ease, and is distinguished for subtlety and humour. The MSS. of his works are papyri found at Thebes in Egypt (1847 and 1856). They are earlier than 300 A.D., and comprise fragments of two private speeches, and of the speech against Demosthenes, and a large part of the Funeral Oration over the victims of the Athenian defeat at Melitea in the Samian War. This last speech is the best extant specimen of the epideictic oratory of the ancient Greeks. The fragments were edited by F. Bläss, Leipzig (1869).

Hyper-metamorphosis, a type of metamorphosis of insects in which an additional stage is present, such as the campodiiform stage of *Mantispa*.

Hypermetropia. [EYE, DISEASES OF.]

Hyperodapedon, an extinct genus of lizard-like reptiles, comprising *H. gordoni*, six or seven feet long, from the Triassic sandstone of Elgin, and *H. huxleyi*, seventeen feet long, from strata of the same age at Maledi, in India. They appear to have been terrestrial animals with four limbs, but no spines or bony plates. The vertebrae are bi-concave, the ribs single-headed; and there are a well-developed breast-bone and abdominal ribs. The skull is compressed and broadly triangular, whilst the premaxillaries seem to have been prolonged into a sharp recurved beak which must have had a horny sheath like the mandible of a bird of prey. For this reason this and similar extinct reptiles, with the genus *Hatteria*, now living in New Zealand, have been placed in a separate order, *Rhynchocephalia*. The teeth are also very exceptional, there being several rows of closely-set, low, conical teeth on the maxillary and palatine bones, forming posteriorly a deep groove, into which

at the small marginal teeth of the mandible, which become worn into a sharp cutting edge, whilst there are also larger blunt teeth on the inner side of the mandible.

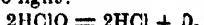
Hypersthene, one of the rhombic pyroxene group of minerals. It is a silicate of magnesium and iron, containing from 11 to 26 per cent. of the former, and from 10 to 34 per cent. of the latter. It crystallises in the Prismatic system, in forms identical with those of enstatite, and has a well-developed cleavage, so as to be very generally foliated. It is brownish green, greyish, or nearly black, with a pearly or coppery metalloid lustre on the cleavage surfaces. It is brittle; but has a hardness of 5 to 6, and specific gravity of 3.3 to 3.4. It may be translucent, and is distinctly pleochroic. It fuses to a black enamel or to a magnetic mass. With labradorite felspar it forms the rock *hypersthenite*, and it is a frequent accessory mineral, especially in schists. It occurs largely in the Cuillin Hills of Skye.

Hypertrophy, or overgrowth of an organ results from increased use and increased supply of nutrient. The hypertrophy may be a healthy development, as, for example, in the muscular tissue of an athlete; or it may be the result of an attempt to compensate the mischief produced in some diseased process, as in the hypertrophy of the heart in certain forms of cardiac disease; or the term may be applied to the increase in size of an organ produced by morbid growth within it, as in hypertrophy of the liver, thyroid gland, etc.

Hypha, an elongated cylindrical filamentous structure, either unsegmented (unicellular) or segmented (multicellular), branched or unbranched and increasing by apical growth, which occurs in some algae and most fungi. Whether segmented or not, a hypha generally contains many nuclei. Loops frequently unite distinct threads, and *clamp-connections*, by a protuberance extending backwards at a transverse wall and joining the next cell, also occur. Fungal mycelium or "spawn" commonly consists of much branched unsegmented hyphae; and the so-called "compound thallus" of the larger fungi is made up of numerous multicellular hyphae, either densely interwoven into a felt (*tela contexta*) or parallel and firmly adherent. They then so resemble parenchymatous tissue, the result of cell-division, as to be called *pseudo-parenchyma*.

Hypnotism. [ANIMAL MAGNETISM.]

Hypochlorites are the salts of an unstable *hypochlorous acid*, HClO . This acid is only obtained in dilute solutions, and is readily decomposed on exposure to light:



The hypochlorites themselves show also this instability, and of them the most important is the calcium salt which is contained in bleaching powder (q.v.). The other hypochlorites, as well as the acid itself, possess bleaching powers, all owing to the liberation of oxygen.

Hypochondriasis, a form of disease which sometimes affects middle-aged and elderly men.

The chief symptoms are anxiety, depression of spirits, and there may be actual delusions; it is often associated with dyspepsia. These symptoms may all clear up under appropriate treatment, but in some instances they are associated with the onset of some definite form of organic disease.

Hypocycloid, in geometry, is a special curve traced out by a point on a circle rolling inside another. It is therefore an example of the family of curves known as roulettes (q.v.), and approximates to the ordinary cycloidal curves when the fixed circle is increased in size. [EPICYCLOID.]

Hypoderm, that part of the fundamental tissue in plants immediately beneath the epidermis. It is very frequently thickened so as to add to the mechanical strength of the structure, being in petioles, peduncles, and herbaceous stem-structures commonly collenchymatous, having, that is, the corners of its cells thickened mucilaginous.

Hypogene Action, the collective term for all those geological agencies, several of which are most imperfectly known, which act from below the earth's surface. They may, perhaps, be grouped under five heads:—(1) volcanic, (2) seismic, (3) those producing slow secular or widespread movements, (4) those producing folding and faulting of strata, and (5) metamorphic. How little our certain knowledge of these agencies is, may be gathered from our being only able to name several of them by their effects; but one great cause probably underlying most of them is the heated condition of the interior of the earth. [EARTH.] The action of volcanoes, of earthquakes (seismic action), and of metamorphism is dealt with under separate headings. Secular movements of upheaval or depression may occur in volcanic regions, and be merely a part of the volcanic phenomena, as would seem to be the case with the so-called Serapeum (q.v.) near Naples. If not, they may really be of local origin, as when beds of rock-salt or gypsum are dissolved, and produce subsidence, or when hydration of a mineral substance causes expansion. It has been suggested that elevation may be produced by denudation (q.v.) reducing the pressure on a heated interior; and depression by the weight of deposits on the ocean-floor acting upon a yielding internal region, such as a molten zone between the solid crust of the earth and a solid nucleus. Another view is that all such movements are but the expression of the shrinkage of the earth due to its cooling, the crust accommodating itself to the shrinking interior. Such shrinkage would certainly produce extreme tangential, lateral, or horizontal pressure, and this pressure would give rise to such molar changes as folding into anticlines (q.v.) and synclines, contortion, inversion, shearing (q.v.), and faults (q.v.), and to such molecular or textural changes as cleavage (q.v.) and foliation (q.v.). Speaking generally, while the action of *epigene*, or sub-aërial and marine, agencies is denudation (q.v.), lowering the general surface, hypogene agencies tend rather either to raise the surface, to pour out matter from below or to harden rocks (by crystallisation) against denuding forces.

Hypogynous, inserted below the ovary, a term applied to corolla and stamens in certain flowering plants in which the floral receptacle or thalamus retains the typically elongate form of a shoot, not being peripherally expanded into a disc or cup, so that the floral leaves succeed one another in acropetal succession directly upon it. This character is well illustrated by a section of the flower of a buttercup, as contrasted with one through the perigynous (q.v.) flower of a bramble. Insertion is a character of great importance in the classification of angiosperms (q.v.), and hypogynous insertion gives the name *Hypogynæ* to series of Petaloid Monocotyledons, of Incompletæ (q.v.), and of Gamopetalæ (q.v.), whilst the practically synonymous term *thalamiflora* gives the name *Thalamifloræ* to a series of Polypetalous Dicotyledons.

Hyponasty, the more rapid growth of the under surface of a dorsi-ventral organ in a plant, such as a leaf. It commonly alternates at long intervals with epinasty, the more rapid growth of the upper surface. In an ordinary leaf-bud, for example, hyponasty makes the young leaves at first arch inwards over the apex of the stem, and then epinasty causes them to spread outwards and downwards into a horizontally expanded condition. Horse-chestnut leaves are somewhat exceptional in epinasty in their case preceding hyponasty, so that the latter causes them to rise outwards and upwards into the horizontal.

Hypophosphites, salts of hypophosphorous acid, H_3FO_2 , all of which, like the acid itself, are possessed of strong reducing properties.

Hypsulphites. These compounds are really the salts of *hyposulphurous acid*, H_2SO_2 , and are of little other than chemical importance. The name *hyposulphite* has been, however, unfortunately applied to the thiosulphates, $H_2S_2O_3$, especially in the case of the sodium salt $Na_2S_2O_3$. This substance is very largely employed in many industrial and technical processes, and especially in photography. For the latter purpose "hypo"—as it is often familiarly called—owes its application to the fact that it forms with silver salts a soluble compound $AgNaS_2O_3$, which can be washed out of films, etc., by water. It is therefore used for getting rid of silver compounds which have not been affected by the action of light in the operation known as "fixing" (q.v.).

Hypothenuse, in geometry, is the side opposite to the right angle in a right-angled triangle. The well-known Pythagoras' theorem, the 47th proposition in Euclid's first book, is that the square on the hypothenuse is equal in area to the sum of the squares on the other two sides.

Hypotricha, an order of Infusoria, including those in which the cilia occur only on the ventral side.

Hypoxanthine, a nitrogenous substance of composition $C_6H_4N_4O$, which occurs in the animal organism, e.g. in the spleen, bone-marrow, muscle, etc. It is usually contained in meat extracts, and frequently found associated with *theine* in tea. It

forms white crystalline needles, which are only slightly soluble in water. In its chemical relations it is closely related to *guanine*, *xanthine*, and *uric acid*, and other products of animal activity.

Hypsometer, an instrument for the determination of heights by observation of the boiling-point of water. It consists of a small boiler heated by a spirit-lamp, and a sensitive thermometer graduated only in the region of 100° C. The thermometer is arranged so that its bulb is in the steam rising from the boiling water. A table of values of atmospheric pressure with corresponding boiling-points of water gives at once the pressure, the difference between which and that at another known level may be employed to calculate the height from that position. The instrument is arranged in telescopic form for convenience of packing.

Hypsophyll, or **HYPSPHYLLARY LEAF.**
[BRACT.]

Hyracodon, a genus of rhinoceros-like animals found in the Miocene rocks of Dakota, and described by Professors Leidy and Cope. They have the same number of teeth as the Rhinoceros (q.v.), though of a more generalised type, but only three digits on each foot.

Hyracoidæ, a sub-order of Ungulates, with a single family Procaviidæ (= the lapsed Hyracidæ). The dental formula is $1\frac{1}{2} \text{ C} \frac{1}{1} \text{ PM} \frac{1}{1} \text{ M} \frac{3}{3} = 34$. There are four functional digits on the fore limbs, and three on the hinder ones, each with a hoof-like nail. The brain and skull are of the Ungulate pattern, and the cheek teeth like those of the Rhinoceros.

Hyrax, the English name of any individual of the genus Procavia (of which it is a synonym). There are fourteen species (three with sub-species), ranging from Syria down the east coast of Africa to the Cape, and up the west coast to the Senegal river. In form they are not unlike the marmot, but are larger and more stoutly built, and the soft fur is brown or grey in colour. They are social in habit, and live among rocks or in trees, and their diet is exclusively vegetable. The upper lip is cleft like that of the rodents, and the formation of the feet enables them to cling to vertical surfaces, as do the Geckos. They are extremely wary, and place sentinels to give warning of approaching danger; but when taken they soon become accustomed to captivity, and make amusing and affectionate pets. The Syrian Hyrax (*P. syriacus*) is the "cony" of Scripture, and the mistaken notion of the Jews that it chewed the cud probably arose from the fact that its jaws move almost incessantly like those of a ruminant. *P. capensis* is the Cape Hyrax or Rock Badger; *P. arboreus* and *P. dorsalis* are arboreal forms, formerly placed in the genus or sub-genus Dendrohyrax (from south-west Africa).

Hyrcanus, High-priest of the Jews (B.C. 78-30), succeeding his father, and king (B.C. 69-47), succeeding his mother Alexandria, was the last prince of the dynasty of Joannes Hyrcanus, son of Simon Maccabæus. Hyrcanus' younger brother, Aristobulus, rebelled, and drove him from the throne. Pompey restored Hyrcanus' power (63), and took Aristobulus and his son to Rome; but they escaped, and their

rebellious attempts gave the real sway over Judea to Antipater, an Idumean, whom Cesar (47) made Procurator of Judaea. Hyrcanus had Antipater removed by poison (43); but weakly allowed Antipater's son, Herod, to succeed to his father's power. The Parthians carried off the feeble Hyrcanus (40), and detained him in Babylon for several years, but at last he returned to Jerusalem at Herod's invitation. He was put to death by Herod (30) after the battle of Actium.

Hyssop, a genus of Labiate plants, one of which is a native of Southern Europe. Though rather bushy herbs, they are not adapted for brooms or brushes, nor do they grow on walls; and it is probable that the hyssop of Scripture is the spinous twigs of the caper (q.v.).

Hysteresis (*coming short*), a phenomenon of magnetic induction exhibited strongly with ordinary soft iron, by which the intensity of magnetism of the metal when subjected to a varying magnetising force depends not only on the strength of this force but also on the nature of its previous variations. [INDUCTION, MAGNETISM.]

Hysteria is a disease which occurs chiefly in women either at the period of puberty or at that of the climacteric. The characteristic symptom of hysteria is the well-known hysterical fit, the broad features of distinction between which, and an epileptic attack, are the absence of the complete loss of consciousness, of tongue-biting and of lividity, and the noisiness and violence of movement, but avoidance of the infliction of any actual injury, which occur in a hysterical attack. The distinction is not, however, an easy matter in all cases. Other symptoms met with in hysteria are the altered mental condition, perverted sensation (whether it take the form of exulted sensibility, *hyperesthesia*, or loss of sensibility, *anaesthesia*), paralysis, and loss of voice.

Hysteron - proteron (Greek, "the latter first"), is the name given to a figure of speech in which what should, logically or in order of time, come first is placed last and *vice versa*.

Hystrix. [PORCUPINE.]

Hythe, a municipal and parliamentary borough and watering-place of Kent, one of the old Cinque Ports, now half a mile from the sea, on a branch line of the S.E. Railway. The fine church dedicated to St. Leonard, late Norman and Early English, has been handsomely restored. Beneath the chancel is an immense collection of skulls—many having deep cuts in them—and bones; of their age and origin no satisfactory account has been given. It stands on the slope of the steep hill which rises behind the long street of which the town mainly consists. The parliamentary borough includes Folkestone, which is five miles to the east; a Government school for training instructors in musketry and marksmen was founded in 1854, when fine baths were built; a noble avenue of wych-elms leads from the town to the sea-wall and parade, which extend to Sandgate. Pop. (1901), 5,557.

I

I, the ninth letter of our alphabet, was derived through the Greeks from the Phœnicians, and ultimately from the Egyptian hieroglyphics. Its original form somewhat resembled a *z*, which became a vertical stroke after the omission of the additional strokes forming the upper and lower angles. The proper sound of *i* is that which it has in *machine*—a sound which still belongs to it in most European languages, but which in English now gives its name to the letter *e*. This sound appears in a weakened form in the "short *i*" of *bit*, etc., which is the normal sound of the letter in English, whereas that from which it takes name occurs only when a final *e* or a guttural follows in the next syllable—e.g. *bite, high*. [J, Y.]

Iagnobs, a people of East Turkestan, who give their name to the Iagnob affluent of the Upper Zerafshan river; they are of Galcha stock, and the only known member of this group who speak a distinct Aryan language unintelligible to all the surrounding Galchas, who are of Persian speech. Like their neighbours, the Iagnobs are Mohammedans of the Sunni sect, occupied chiefly with stock-breeding. (Ch. de Ujfalvy, *Rev. d'Anthropologie*, 1879, Jan., p. 8.),

Iambics, verses in which the normal form of each foot is an *iambus*, i.e. a short syllable followed by a long one. They are said to have been invented by the Greek poet Archilochus (q.v.). Substituting stress for quantity, English blank verse consists of iambic lines, each containing five feet.

Ibanags, a Malay people, Philippine Archipelago, province of Cagayan, island of Luzon and neighbouring Babuyan and Batanes islets. The Ibanags, whose language is the chief medium of intercourse between the settled populations and the surrounding wild tribes, are a fierce, warlike nation, whose reduction cost the Spaniards more trouble than that of any other people in Luzon. Those of the Batanes Isles are still mostly pagans; but nearly all the rest have been nominal Roman Catholics since the end of the sixteenth century. They cultivate tobacco and rice, own large herds of swine and goats, and emigrate in considerable numbers, especially to Manila. (Fr. Blumentritt, *Ethnologie der Philippinen*.)

Ibaras, a people of Madagascar, south and south-west districts of the province of Betsileo. Like the allied Betsileos of the central districts, they live in the so-called *ralas*, that is, groups of three or four huts, each surrounded by a mud wall and a quickset cactus hedge. The Ibaras are still for the most part nature worshippers, and, according to J. Mullens, who visited them in 1875, number about 200,000 souls. In their territory is the remarkable Mount Ivahibé, an isolated table with a lacustine depression on the summit whence, during the rainy season, the lake sends its overflow through a wild gorge and magnificent cascade down to the surrounding plains.

Iberis, a genus of cruciferous plants, comprising about twenty species, natives of Europe, Eastern Asia, and Northern Africa, of which one, *Iberis amara*, is British. They are smooth plants, with crowded flat-topped inflorescences of flowers which, though sometimes pink or red, are usually white, whence they are known as "candy-tuft." The outer flowers are remarkable for having their two outer petals larger than the others.

Ibex. [GOAT.]

Ibilaos, a wild tribe, Philippine archipelago, who occupy both slopes of the Caraballo Sur range between the provinces of Nueva Vizcaya and Nueva Ecija, island of Luzon. The Ibilaos appear to be half-caste Malays and Negrito, of dwarfish size and very dark complexion, cultivating no land, but living entirely on the chase, and also given to head-hunting, like so many of the uncivilised Malay peoples. A few of their hordes have been reduced, and now live in peace with the settled populations of Nueva Ecija. (Fr. Blumentritt.)

Ibis, a genus of Stork-like birds of the family Plataleidae, of varying extent in different classifications. As a popular name it is applied to some thirty forms, not much unlike curlews in shape, most abundant in the tropics, though some are almost cosmopolitan, and others are from the temperate parts of America. They have the following characters in common: the neck is long and generally naked, the head is small, with a long sickle-shaped bill, curving downwards; the legs are long and thin, the toes of moderate size, the three in front connected by a short membrane, and armed with narrow pointed claws, the middle one denticulated. The wings are long, broad, and rounded, and the short tail is of twelve feathers. The general



IBIS (*Ibis aethiopica*).

plumage is white with black primaries, and in some the wing coverts are elongated and form a plume covering the tail. They feed on frogs, lizards, molluscs, and water insects. The best-known is the Sacred or Egyptian Ibis (*I. aethiopica*), about thirty inches long, formerly venerated in Egypt, of which country it is now no longer a native, only

straying thither from other parts of Africa. It is often seen in confinement. The Glossy Ibis (*I. falcinellus*), ranges from Africa and Asia into Southern Europe, and has strayed to Britain. Montagu says that it is the original of the "Liver" that figures in the arms of Liverpool. The White Ibis (*I. alba*) is a native of Florida, and the Scarlet Ibis (*I. rubra*) of tropical America.

Iblis (EBLEES), the Devil of the Mohammedans. Originally an angel, he was cast out of Paradise for refusing to worship Adam. (*The Korán*, ch. vii.). [EBLIS.]

Ibn Batute, a famous Mohammedan traveller, who appears to have been born at Tangier in 1304, and to have died there at the age of seventy-three. From 1325 to 1355 he was incessantly engaged in travel, and the record of his adventures, if marked here and there by apocryphal incidents, bears the stamp of truth in the main. His itinerary begins along the south coast of the Mediterranean and, striking inland to Cairo, extends to Damascene, Mecca, Ispahan, Bagdad, Aden, Mombassa, Quilon, and the Persian Gulf. He then worked his way back to Egypt and thence through Syria and Asia Minor to the Black Sea. Joining the chief, Mahomed Usbez, he saw a good deal of Russia, visited Constantinople, and then starting from Sarai struck across the steppes, traversed Khorassan and Cabul, climbed the Hindu Kush, and reached the Indus. He next found his way to Delhi, of which city he was for eight years Kadi, and being despatched on a mission to China, professed, after wanderings which took him through much of India and the Eastern Archipelago, to have got as far as Cambaluc or Pekin. Coming home at last, after an absence of twenty-four years, he finished up with a little trip to Timbuctoo and the Niger, and then settled down to write his adventures.

Ibo (IGBO), a large Negro people of the Lower Niger basin, whose domain comprises all the northern part of the delta, extensive tracts in Yorubaland, and most of the space intervening between the head of the delta and the Oyono (Cross) river above the Old Calabar estuary. The Ibo language, which is spoken by several millions on the Slave Coast and in the Oil Rivers Territory, is fundamentally connected with the Ewe of Dahomey and the Tshi of the Gold Coast. There are many distinct dialects, but the form current along the banks of the Lower Niger has become the literary standard, having been adopted by the missionaries for their translations of the Bible, grammars, and dictionaries. So numerous were the blacks of Ibo speech formerly shipped to the American plantations that all those exported from the Slave Coast were indifferently called "Ibos." Many have been evangelised; but the great majority are still heathens, worshipping Chuku, a powerful demon, who dwells partly in a cave, partly in the sky, thus keeping one eye on the earth, the other on the starry firmament. Till recently he was offered human sacrifices—generally young girls—who were dragged to death in his honour and then thrown to the crocodiles. Amongst the Ibos the social classes

are distinguished by special tattoo markings, one of which is a sort of visor formed by the skin of the forehead brought down over the eyes. The highest class, limited to very few members, are known by the tinkling bells attached to their legs when they go abroad. Lately the Ibos have recognised the suzerainty of the British Chartered Companies, and have engaged to give up most of their former barbarous customs. (Reclus, English ed. xii., p. 330; Baikie, *Exploring Voyage*, p. 307; Bishop Crowther, *Journals*, p. 355.)

Iboguelans, a small but fierce Tuareg (Berber) tribe, "the terror of the Sahara" (Duveyrier). They are a branch of the powerful Kel-Khela family, and have their camping grounds on the western slope of the Ahaggar plateau, whence they swoop down on the caravans along the trade route between Timbuktu and the Twat Oasis. The Iboguelans belong to the noble class of Tuaregs, and consequently do no work, but hold in subjection the two servile Masselitzen and Iberberen tribes, who till the land, tend the flocks, and do all the manual labour. (H. Duveyrier, *Les Tuareg du Nord*.)

Ibsen, HENRIK, was born at Skien, Norway, in 1828, and derived from his mother a strain of German and Scottish blood. He was educated for the medical profession, but soon took to literature, his first effort being a drama, *Catilina* (1850) which was not successful. Next year, whilst a student in the university of Christiania, he started a paper in which he wrote his earliest political satire, *Norma, or a Politician's Love*. He was appointed manager of the theatre at Bergen in 1852, and went to Christiania in the same capacity five years later. It was not until 1862, after the financial failure of the theatre, that he adopted the functions of a dramatic satirist, and began to illustrate his psychological and social theories in the series of creations that has made him famous. *Love's Comedy* (1863) marks the turning-point of his career. His two great poems, *Brand* and *Peer Gynt*, appeared in 1866-67. Between 1877 and 1890 he has given to the world *The Pillars of Society*, *Ghosts*, *An Enemy of Society*, *Nora, or A Doll's House*, *The Wild Duck*, *Rosmersholm*, *Hedda Gabler*, *The Master Builder*, *Little Eyolf*, *John Gabriel Borkman*, and *When we Dead Awaken*. All of these have been translated into English, and most of them put upon the stage in this country, where they called forth excited criticism. Ibsen never forgave his country for holding aloof from Denmark in 1864, and lived abroad for nearly thirty years, part of this period being spent in Italy, part at Munich. His *Letters* were published in 1905. He died in 1906.

Thycus, a Greek lyric poet of whose works but few fragments remain. He was a native of Rhegium in Italy, but flourished at the Court of Polycrates of Samos about 540 B.C. He is said to have been killed by robbers near Corinth, and to have called with his dying voice upon a passing flock of cranes to avenge him. The murderers were soon after seated in the theatre when the cranes put in an appearance. One of the guilty wretches inadvertently cried out "See! the avengers of Ibycus!"

and thus betrayed himself. "The cranes of Ibycus" became a popular proverb among the Greeks.

Ice, the solid crystalline form of water (q.v.) which that substance assumes at a low temperature, originates in many different ways in nature. Precipitated from the air as hoar-frost (q.v.), hail (q.v.), or snow (q.v.), accumulating in this latter form above precipices to fall as the avalanche (q.v.), or, on more gradual slopes, to glide as the glacier (q.v.) until, perhaps reaching the sea, it breaks off in the iceberg (q.v.), forming in deep or elevated and sunless caverns, on the open surface of fresh water, on the sea itself, or, as ground-ice, at the bottom of the water, it naturally presents many varied characteristics. The temperature at which it forms, under ordinary conditions of pressure, is the zero (0°) of the Centigrade and Réaumur thermometer-scales, and is 32° Fahrenheit. By melting out single negative crystals with a beam of electric light it is shown that sheet-ice is equally with snow made up of crystals of hexagonal type. Water expands in freezing, its maximum density being attained at 39° F. or 4° C.; and though ice, so long as it remains ice, behaves like most solids in contracting in cooling and expanding when heated, in melting it contracts. Its specific heat is about half that of water—i.e. the heat required to raise 1 lb. of ice through 1° C. is only sufficient to raise half a pound of water through 1°. In the melting of ice there is no rise of temperature, but 79.25 heat-units are rendered latent in the process, or are employed merely in changing the condition of the solid into that of a liquid, without any increase of temperature—i.e. it takes as much heat to convert 1 lb. of ice at 0° C. into water at 0° C. as would raise 1 lb. of water from 0° C. to 79.25° C.

When two blocks of ice at 0° C. are pressed together, melting takes place, heat is absorbed, the pressure is momentarily relieved, and the resulting water re-freezes, so that the two blocks become welded in one. This process, which is known as *regelation*, explains the "binding" of a snow-ball and, to a considerable extent, the flow of a glacier.

Fresh-water, when cooled by contact with cold air down to 4° C., sinks, and not until the whole mass is reduced to that temperature, so that further convection currents are impossible, does ice form at the surface. Sea-water, when stagnant, freezes at about -2° C. or 29° F., and in so freezing precipitates most of its salt, much as dirty water throws down most of the mud it contains. Water, whether fresh or salt, resting on an uneven bed, such as that of the Baltic, the Gulf of St. Lawrence, the Upper Thames, and the Christchurch Avon, is apt to form what is known as *ground-ice*, *bottom-ice*, or *anchor-ice*, cakes of ice forming from radiation in contact with large stones, or even anchors, at the bottom, especially in relatively stagnant holes, and often floating them to the surface. Along the sea-coast or on the banks of tidal rivers a ledge of ice is often formed, by a similar process of radiation, adherent to the bank at the highest tide-level,

which is known as *ice-foot*. It may be subsequently floated off, or lifted by a fresh layer formed below it and reattached still higher, thus forming a thick shelf on which *débris* due to frost-action may accumulate. Masses of ice-foot when detached form small flat bergs. When, in polar regions, the surface of the sea freezes it is known as *floe* (meadow) *ice*. Wave-action commonly breaks this up and heaps it in an irregular manner that much impedes the transit of Arctic explorers. When the floe-ice breaks up in summer, "canals" forming throughout it, it is known as *pack-ice*, and it is the violent collisions of masses of this pack that so frequently "nip" and destroy vessels.

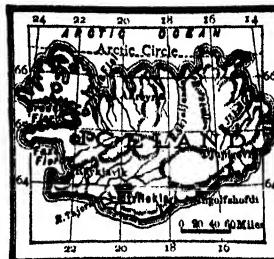
Iceberg, a mass of ice detached from a glacier where it enters the sea. Icebergs vary greatly in shape and size, lofty peaked forms, sometimes 200 or 300 feet above the water, being the more common. In the Antarctic Ocean huge and regular tabular bergs occur, sometimes five miles in length, and presenting a stratified appearance, the ice becoming denser and darker blue downwards. Only about an eighth part of an iceberg is above water, so that in shallow water they may run aground, ploughing up the sea-bottom. They are generally strewn over with stones of all sizes up to that of a house: cascades of water pour from their melting summits; and they transport Arctic bears and foxes occasionally, besides affording a retreat to seals. In the North Atlantic the bergs are carried by ocean currents to the shores of Newfoundland, or farther south; and, as they often, by cooling the surrounding air, shroud themselves in mist, they form a serious danger to navigation. The melting of the submerged portion frequently causes icebergs to capsise.

Iceland (Dan. ISLAND) is a volcanic island in the North Atlantic Ocean, 500 miles from Scotland, and 250 miles from Greenland. It has a length of 300 miles, and a breadth of 200, the area being about 39,200 square miles. All the central portion is occupied by a vast plateau raised about 2,000 feet above sea-level and presenting a dreary expanse of sand and lava broken by jökulls or ice-mountains reaching in some cases a height of 6,500 feet. The largest of these, Vatnajökull, lies to the S.W. and covers 4,000 square miles. Its E. margin approaches closely to the sea, but on the other side the country opens out into valleys until, on passing the ridges of Hecla, the Torfajökull and the Eyjafjallajökull, the Rangarvalla, an extensive and well-watered plain, is reached. This communicates with the valleys that fringe the bay of Faxaflói, in the S. bend of which stands Reykavik, the capital. The promontory of Snæfellsness divides Faxaflói from the Breidifjörður inlet, and the N.W. corner of the island consists of a rugged peninsula. The N. coast beyond is deeply indented with fiords, whilst the S. shore offers but scanty harbour accommodation. The habitable portion of the island seldom extends more than 50 miles from the sea, and the soil yields little but grass, on which the sheep, cattle, and ponies—the chief sources of livelihood—are pastured. Spade husbandry produces a few potatoes, carrots, and turnips. Fish abounds both

in the sea and the numerous streams, and the down of eider-duck supplies a valuable export. There are no industries, save the spinning and weaving of coarse woollen fabrics. A little sulphur is worked, and the bogs yield peat for fuel, but such mineral resources as exist—iron, aluminium, spar and lignite—hardly pay for development. The climate, especially in the S., is by no means severe, the winter temperature averaging about 30° Fahrenheit, but the N. littoral is colder and dryer. The air is clear, bright, and invigorating. Traces of volcanic agency of older or later date are discernible everywhere, and within the memory of man at least twenty-five craters have been in active operation, but Hecla has been quiescent since 1846, and the Katla was the scene of the last eruption in 1860. Earthquakes occur frequently, being felt most sharply in the W., and geysers are found in several quarters.

The recent constitution, dating from 1874, bestows the legislative power on the King of Denmark and the Al-thing or Representative Assembly, which is made up of 34 elected members and 6 others, nominated by the Crown, and is divided into two chambers. A governor-general, two lieutenant-governors, for the two parts of the island, and a number of sheriffs form the executive and judicial staff, whilst there are local councils for the administration of the poor law and for similar purposes. Under the constitutional law of 1903, a Minister for Iceland, nominated by the Crown, resides at Reykjavik, and is responsible for the administration.

Ethnology. It appears from the Norse records and other indications that the first inhabitants of Iceland were a few Irish Christians, who, however, were all expelled by the pagan Norsemen who, flying from the tyranny of the Norwegian usurper Harald Haarfager, arrived in the island soon after 872. Others followed, also mostly from Norway, down to the year 1000, when all accepted the teachings of the Christian missionaries Gizur and Hialti. Then immigration virtually ceased, or was later restricted to a few Danish officials and others when the island passed from Norway to Denmark by the treaty of Kalmar (1397). Thus it happens that the great bulk of the present inhabitants are direct descendants of those early Norwegian settlers, whom they still resemble in physique and language. The modern Icelanders are generally of tall stature, with round faces, blue or grey eyes, long fair hair or brown hair, coarse figures and ungainly carriage. Infant mortality is high, even excessive in some districts, and appears due partly to the increasing rigour of the climate, partly to close unions, unsanitary conditions, premature weaning, and coarse and unwholesome food. This, combined with



MAP OF ICELAND.

emigration to the United States and Canada, tends to keep the population stationary (71,300 in 1876, 72,438 in 1880, 70,927 in 1890, 75,668 in 1901).

The Icelanders are distinguished by their intelligence, love of study, personal dignity, reserve and courage; but they are said to be excessively suspicious, quarrelsome and apathetic at home, though active and enterprising abroad. Thanks to their isolated position and the general spread of education, they have preserved with little change the old Norse (Norwegian) language of the 9th century, which was considerably cultivated, especially in the 18th and 14th centuries. From this period dates the composition of all their literary monuments collectively comprised under the name of *sagas* ("sayings"), and embodying mythological and national epics and other poems, histories, as well as didactic prose works, such as the prose *Edda* attributed to the poet and historian Snorro Sturleson, and containing treatises on mythology, grammar, rhetoric and the laws of Norse versification. The poetic forms were exceedingly complex and artificial, so that poetic composition soon degenerated into literary *tours de force* lacking all natural feeling and retaining merely the dry bones of the early national poetry. In more recent times the Icelanders have distinguished themselves in other branches of art and science, and the father of the Danish sculptor Thorwaldsen was a native of Iceland.

Iceland Moss (*Cetraria islandica*), a lichen, native to Iceland, Scandinavia and mountainous districts of Britain and Europe generally. It is ground up with flour and added to soups in Iceland; but is little used there, and is not exported. It is, however, collected in Sweden as a food and medicine. It contains 70 per cent. of *lichenin*, a mucilaginous modification of starch, and a bitter acid principle which may have some slight medicinal properties, but is usually removed by soaking the "moss" in water or dilute solution of carbonate of soda. Iceland moss, when boiled, forms a jelly which is mixed with wine or milk; or it is ground up with cocoa; and it is supposed to be useful in pulmonary complaints; but is merely demulcent and very slightly nutritious.

Iceland-spar. [CALTITE.]

Ice-plant (*Mesembryanthemum crystallinum*), a native of South Africa, the Canaries, and Greece, so named from the water-containing glands, resembling particles of ice, with which the trailing, fleshy stem and the leaves of the plant are studded. These glands also feel cool, so that the plant is often used as a garnish to dessert dishes. Large quantities are burnt in the Canaries, the ashes being exported to Spain for glass-making.

Ice-spar, the naturally occurring double fluoride of soda and aluminium, Na_2AlF_6 , found chiefly in Greenland, and more commonly known by the name of *cryolite* (q.v.).

Ichang, YCHANG or YLIN, a town in the province of Hoo-pih, China, about 370 miles above Hankow on the Yang-tze-Kiang. Since it was opened to foreign

trade by the treaty of 1877 the business has increased enormously, especially in trepang.

Ichneumon, any individual of the genus *Herpestes*, of the Civet family, with twenty-two species from Asia and Africa, one straying into Spain. They resemble weasels in form, but are of larger size, and feed on small mammals, reptiles, poultry, eggs, and insects. The Egyptian Ichneumon (*H. ichneumon*), rather less than three feet long, has grey fur, and the muzzle and paws black. It has long been domesticated, for killing rats and mice, and was venerated by the ancient Egyptians. The so-called Andalusian variety is identical. The Mongoose (*H. griseus*), an Indian species, is rather smaller. It is a great destroyer of serpents, but the stories told of its seeking a remedial herb when bitten are fabulous.

Ichneumon Flies (*Ichneumonidae*), a family of Hymenoptera, of which the larvae are footless and live as parasites in the tissues of other insects.

Ichthyodornites, the strong, bony, defensive spines of fossil shark-like fishes. Except in one or two Carboniferous genera, in which they were attached to the pectoral fins, these spines were imbedded in the muscular tissue in front of the dorsal fins. They were formidable weapons, sometimes nearly a foot long, and furnished with recurved denticles, capable of inflicting a serious wound. Their variously-ribbed or tuberculate exposed surface is enamelled with ganoine. In some cases, as in the living *Chimura*, they have a broadly-expanded wing-like base imbedded in muscle. Many of them have not been with certainty correlated with particular skeletons; but in other cases they have been found in their natural position.

Ichthyopsida, the lowest of three primary groups of True Vertebrates, containing the fishes and amphibians. Respiration takes place by gills during part or the whole of life.

Ichthyosaurus, the fish-lizard, the only genus of an extinct order of reptiles, the Ichthyopterygia. More than thirty species have been described from the Secondary rocks of the Old World, especially from the Lias, and, very perfect specimens of both young and adult forms having been obtained, their anatomy is very completely known. They are sometimes thirty feet long, and somewhat resemble the dolphin in general form. The head is large, having a long, gavial-like snout and very large orbits; but a very small brain cavity. The jaws, sometimes six feet long, may contain over 180 teeth, which are conical, and are not in distinct sockets, as in the crocodile, but in a common alveolar groove, and can be replaced from below. The eyes are surrounded by bony sclerotic plates, like those in turtles, owls, etc., the whole orbit sometimes reaching fourteen inches in diameter. The neck is so short as to be probably invisible externally, and the numerous vertebrae are deeply biconcave, like those of fishes. The tail is long and tapering; and from its extremity being generally found in a dislocated condition, Owen assumed a large vertical caudal fin, the presence of which has been recently demonstrated in exceptionally perfect specimens. The

limbs are short, the hind ones being the smaller, and they terminate in paddles with rows of marginal ossicles in addition to the five usual digits. There are numerous slender ribs, but no breast-bone. Traces of the skin have been found, and show no sign of scales or bony plates. The discovery of half-digested remains of fish, reptiles, and young ichthyosaurs within their ribs and in their spirally-convoluted coprolites (q.v.), which are two to four inches long, point to the predatory habits of the animals. They may have crawled on land, like seals; but were adapted for deep water, being better able to remain under water than warm-blooded animals such as whales or seals.

Iconium (Gr. IKONION, mod. KONIEH), an ancient city of Asia Minor, formerly the capital of Lycaonia, and now of the Turkish province of Karaman, is situated 310 miles east of Smyrna on the edge of the great central plateau. On the highway between Antioch and Derbe, and surrounded by a fertile country, it became a place of importance even in the time of Xenophon. St. Paul founded a Christian church here, and thrice visited the spot. The walls of the old city may still be traced within the circuit of those erected in the thirteenth century, and the ruins of the citadel and of the Byzantine church of St. Thecla may be seen amongst mosques and shrines of a later date. There is some trade in carpets and morocco leather, but the former prosperity has dwindled away under Turkish rule.

Iconoclasts, "image-breakers" (Greek *eikon*, "image" and *klazo*, "I break"), a party opposed to the presence of statues and pictures in churches which arose in the Eastern Church at the beginning of the eighth century. A feeling against images, occasioned mainly by the fear of idolatry, had existed from an early period, and their use was forbidden by the Council of Elvira in Spain (306). But a great variety of opinion and practice prevailed, culminating at last in a bitter controversy in the reign of Leo III., "the Isaurian," Emperor of the East. By his decree in 730 the worship of images was made a capital offence, and it was ordered that they should be removed from churches. Leo's violent measures were opposed not only by the Pope Gregory II. and Gregory III., but by the Patriarch of Constantinople and his clergy. The hostility they encountered in Venice and Ravenna resulted in the loss of the Italian possessions of the Eastern Empire. Constantine Copronymus, son of Leo, pursued the same course, and in a council of Eastern bishops at Constantinople (754) the previous enactments were confirmed. Owing to the influence of the Empress Irene (q.v.), image-worship was re-established at the Deutero-Nicene Council (787); but her successors at Constantinople were for the most part jealous iconoclasts, and the difference between the Eastern and Western Churches on this point contributed, though in a less degree than the *Filioque* controversy, to their final separation. [GREEK CHURCH.]

Ida. 1. A mountain in Asia Minor at the head of the gulf of Adramytii, and thirty miles south-east of the Trojan plain. Here Paris wooed Oenone, and

adjudged the prize of beauty to Venus, bringing ruin on himself and his country. It is now known as Kash-Dagh.

2. The central peak of the island of Crete, the modern name being Psitoriti. As the cradle of Jupiter and the home of his attendants, the Corybantes, it is sometimes confounded with the Trojan Ida. It has an elevation of 7,200 feet.

Idaho, one of the United States, organised as a territory in 1863, and formed by uniting part of the east of Washington and Oregon with slices taken from the west of Nebraska and the north of Utah, so as to make up an area of 86,294 square miles. It adjoins British Columbia to the north. Much of the surface is mountainous and woody, but there are broad and fertile valleys, especially in the north. Towards the south vast tracts are covered by recent basaltic eruptions. Many streams flow down from the Rocky, the Bitter-root, and the Salmon river chains, the largest being the Snake, the Salmon, the Clearwater, and the Spokane. The climate is very dry. Boisee, Idaho City, Malade, Buenavista, and Silver City are the chief centres of population. The mineral resources include gold, silver, copper, iron, coal, and salt, all of which have been worked profitably. The railway from Utah to Montana traverses the lower portion of the territory. It was admitted as the forty-third State of the Union in 1890.

Ida-u-Aish (DWAISH), a large group of confederate Tuareg tribes, West Sahara, extending southwards to the banks of the Senegal. As descendants of the old Guesima Confederacy, they were formerly the most powerful of all the Tuareg people in this region; but owing to internal strife they lost their pre-eminence early in the sixteenth century. At present they are divided into two hostile factions, the *Sherâtis* and *Abahâks*, scattered in isolated communities as far north as the Sus Valley, Morocco.

Ida-u-el-Haj, a widespread group of Tuareg tribes, West Sahara, most of whom are descendants of the ancient Zenaga family; they have played an important part in this region as propagators of Islam and founders of the Mohammedan kingdom of Walata in El-Hodh, at that time inhabited by Negroes from Sûdan. They are divided into numerous factions, one of which, the *Ahel Sidi Mahmûd*, were formerly masters of Adrâr, where their chief settlement was the flourishing market of Waddn. These all claim to be Marabouts, and as such have great influence over the Sherâtis division of the Ida-u-Aish confederacy.

Iddeleigh, THE RIGHT HON. STAFFORD HENRY NORTHCOOTE, EARL OF, G.C.B., was born in 1818. After a distinguished career at Eton and Balliol College, Oxford, he became private secretary in 1843 to Mr. Gladstone, then President of the Board of Trade. In 1851 he succeeded to the baronetcy, and in 1855 entered Parliament as Conservative member for Dudley. In 1859 he became Financial Secretary to the Treasury under Lord Derby, and gave proof of high administrative talents. In 1866 he accepted the Presidency of the Board of Trade, whence

he was transferred two years later to the India Office, where he directed the Abyssinian War with conspicuous skill. Mr. Gladstone, though no longer a political ally, sent him to America in 1871 for the purpose of conducting the *Alabama* negotiations, and on Mr. Disraeli's return to power in 1874 he was made Chancellor of the Exchequer. On the elevation of his chief to the peerage, he took his place as leader of the House of Commons. After Lord Beaconsfield's death he became Lord Salisbury's partner and possible rival in the control of the party. In 1885 he was created a peer, and in 1886 was invited to accept the direction of Foreign Affairs. He soon resigned office, however, and died suddenly a few days later in 1887.

Idea. In the Platonic philosophy the *idea* or *eidos* is the eternal and unchangeable archetype to which all the objects forming a class conform. The world of sense is in a state of perpetual flux—ever coming into existence and ceasing to be—it is the sphere of the *non-existent*, and material objects are real only so far as they partake of the nature of their *eidos*. The ideal world extends wherever there is anything capable of becoming an object of thought; there are ideas of beauty, justice, and truth, as well as of a man, a house, or a tree. All the other ideas culminate in the *Idea of the One*, the Divine Being which is the source of all other being. When the word "idea" was used in this sense, Idealism and Realism were identical, and the mediæval schoolmen who supported the Platonic view were rightly called "Realists." [NOMINALIST.] But with the growth of modern philosophy "idea" assumed a totally different meaning. It was now used by Locke, as previously by Descartes, to denote any presentation or representation in the mind—"whatever is the (immediate) object of the mind in thinking"; while Hume confined it to representations in the mind produced by memory or association, as opposed to impressions which are the direct result of sense-perception. The idea thus came to be regarded as a peculiar property of the mind, and, when schools arose which denied the existence of a material world, they were called "idealists," the notion being that they reduced all existence into "ideas," mental products independent of any agency save that of some mind. On the other hand, those who maintained that the external world has an independent objective existence became known as "realists."

Idiocy. Mental weakness occurring in the infant or child, prior to the development of the reasoning faculties, must be distinguished from *dementia*, which is the condition of mental weakness occurring in the adult. Idiots are not infrequently the offspring of a marriage between near relations; in some instances the disease is hereditary in the sense that other members of the family are affected with one or other form of insanity. It may be directly traceable to injury, and is often associated with epilepsy. The child affected is dull and stupid, he speaks imperfectly or not at all, merely uttering meaningless sounds. His memory is very feeble, and he is incapable of feeding or clothing himself and the like. Much can be

done by appropriate training and education in some instances, hopeless as the condition might at first sight appear.

Idmonæa, the type genus of the *Idmoniidae*, a family of Cyclostomata (q.v.), including many of the more graceful, delicate, branching tufts.

Idolatry is the worship of *idola*, or images generally as the conscious representatives of supernatural beings; and the origin of this practice seems natural enough, if one considers how even the average man of the nineteenth century prefers the concrete to the abstract. In races of low culture the idea of supernatural beings must have been evolved slowly and with great difficulty, and the embodiment of this idea in any figure, however rude, of a man, or even of one of the lower animals marked a distinct advance in the path of religious evolution. For this reason idolatry is not found among races of the lowest culture; and in most cases Fetishism (q.v.) seems to have served as an intermediate stage between Animism (q.v.) and Idolatry but is distinctly inferior to it in this respect—the mere possession of a fetish gave its owner power to compel the indwelling deity, while the being represented by an idol was to be implored. One gets a glimpse of this important distinction even in stock- and stone-worship, for the priests of Baal in their memorable contest with Elijah cried out in the presence of the standing stones on Carmel, "O Baal hear us!" (1 Kings xviii.). This distinction, however, is not always found, as may be seen from Rachel's theft of her father's *teraphim*; where the idea of possession seems to be the dominant one, for she "put them in the camel's furniture, and sat upon them" (Gen. xxxi.). The range of idolatry is wide: it is common among the savages of Polynesia and it flourished in ancient Greece amid the highest civilisation the world has seen; for while to the philosophers—who knew that though "the people had many gods, there could be but One"—the statues of the divinities were at best but symbols to the bulk of the Greeks they were personification or of animated by the dwellers on Olympus. It is present, in a greater or less degree, in all forms of religion except the lowest and those based on Monotheism, and even in these last it often creeps in, either from the limitations of the human mind or by a process akin to that of degeneration in the animal kingdom. Long after worship of Jehovah had become national we find the Jews constantly lapsing into the idol-worship of the Gentiles around them, endeavouring to bring in "strange gods," even proclaiming, as did Aaron, the day on which the *ido* was to be worshipped as a "feast to the Lord" (Exod. xxxii. 5). And this continued to late times, for in Isaiah (lxiv. lxv.), after a purely monotheistic declaration, the prophet describes a gross form of idolatry so vividly that we may be sure it is from personal knowledge. The statues of the Roman, and the pictures of the Greek Church are authoritatively declared to be mere aids to devotion and to be honoured only for the sake of persons they represent; but to very many of the peasants of Italy, or Spain, or Russia, the crucifix or the *ik* is a real idol.

Ifugaos, a Malay people, Philippine archipelago, chiefly in the provinces of Nueva Vizcaya and Isabela, island of Luzon. Formerly their domain lay farther north; but towards the end of the 17th century they were driven by the Gaddanes to their present homes in the hills between the Cagayan and Magat rivers. The Ifugaos, who resemble the Japanese in appearance, are much given to head-hunting, decorating their dwellings with their victims' skulls, and inserting in the distended lobe of the ear a bamboo ring for every man slain. Some of their warriors killed in battle have been found with as many as thirty-two such rings. The captures are made by means of a lasso thrown round the neck of unguarded wayfarers, who are then beheaded with a saw. The Ifugaos are all pagans, at constant war among themselves and with all the surrounding populations.

Igarra (IGALA), a large Negro people of the Lower Niger basin, whose territory extends 100 miles along the left bank of the Niger from the Benue confluence southwards to the Ibo territory, and along the left bank of the Benue to about long. 8° E., where it is conterminous with the Michi domain. They are akin to the Igbiras (q.v.) of Nupé on the right bank of the Niger, and speak a dialect of the Akpotto language common to both peoples. Next to the Ibo this is the most widely-diffused idiom in the Lower Niger region, and has been carefully studied and reduced to written form by the Protestant missionaries. Several Christian stations have been founded amongst them, and since their acceptance of the British protectorate (1887) they have agreed to discontinue human sacrifices and all traffic in slaves.

Igbiras, a large and formerly powerful Negro people of the Lower Niger basin dominant in Nupé, that is, the region stretching along the right bank of the Niger from below the Benue confluence north-west to Borgu (lat. 10° N.) and thence southwards to Yorubaland. Here they had founded a powerful kingdom with capital Fanda (Panda), which was overthrown by the Fulahs about the middle of the nineteenth century. The Igbiras are now governed by a Fulah emir ("prince"), who is himself a vassal of the Fulah emperor of Gando, and since 1886 included in the British protectorate. The ruins of Fanda are still seen at a spot about 50 miles north-west of Lokoja at the Niger-Benue confluence. The Igbiras are a semi-civilised Negroid people, very industrious and great traders. Since the Fulah conquest many have become Mohammedans and a few Christians, but the bulk of the nation remains pagan, though all sanguinary rites have long been discontinued. The language is closely related to Igarra, and forms with it a branch of a primitive Negro tongue with which Nupé proper, Yoruba, Ewe of Dahomey, and Tshi of the Gold Coast are all fundamentally connected. (Bishop Crowther, *Journals*.)

Igen (I-YEN), the aborigines of the Liang-Shan mountains, Yunnan; but the term, meaning "strangers," is applied to and assumed by many hill tribes in west and south-west China who

object to the more usual name Man-tze, which means "untamable worms." (Gill, *Travels*, vol. i. p. 355.)

Ighadhanáren (IHADANÁREN), a noble Tuareg tribe, one of the most turbulent in the North Central Sahara, occupied almost exclusively with fighting and raiding. They are members of the Azjar confederacy, but are constantly shifting their quarters, occasionally encamping amongst the Ahaggars, whence they extend their marauding expeditions as far as the Azwâd district, north of Timbuktu. But their usual camping-ground is on the Admar plain between Tasili of the Azjars and the Anhaf range north and south. Although "nobles" they have no servile tribes under them, but are divided into three distinct groups or castes, Wi-Sattafenin, Wi-Teniflat, and Dergu. (H. Duveyrier, *Les Touareg du Nord*.)

Iglau, or JIHLAVA, a town of Moravia, Austria, is situated on the right bank of the river Iglawa, about 50 miles N.W. of Brunn, and is capital of the circle that bears its name. It has for seven centuries been an important military and commercial centre, consisting of the old fortified burgh with three more modern suburbs. The churches of St. James and St. Ignatius are ancient and handsome structures, and there are the usual public institutions of a provincial capital. Chief among the local industries are cigar-making, cloth- and linen-weaving, iron-working, and brewing, a considerable trade being also carried on in corn and timber. During the Thirty Years' War it was twice taken by the Swedes, and in 1805 the Bavarians under Wrede were defeated under its walls by the Archduke Ferdinand d'Este.

Ignatiess, GENERAL NICHOLAS PAULOVITCH, was born in 1832 and at the age of seventeen entered the Russian Imperial Guard. He served in the Baltic Provinces during the Crimean War, and was afterwards military attaché in London. In 1859 he was sent as ambassador to Pekin, where he concluded a commercial treaty and obtained the cession to Russia of the province of Ussari. In 1864 he took over the embassy at Constantinople, and soon gained considerable ascendancy over Abdul-Aziz. It was not until the conclusion of the Turco-Servian war in 1876 that his Panslavism openly declared itself. The Porte declined to submit to his conditions, and he left his post in order to preach a new crusade to the European Powers. In the end Russia had to undertake the task single-handed, and in 1878 he was entrusted with the negotiation of the Treaty of San Stefano. Gortschakoff's consent to submit that document to the Berlin Conference stirred his indignation so deeply that he retired for a time from public affairs. On the accession of Tsar Alexander III. he was recalled, and appointed Minister of the Interior. His vigorous policy against both Nihilists and Jews proved ineffectual, and he was dismissed after a few months, though still retained on the council of the empire. He died in 1908.

Ignatius, St., surnamed THEOPHORUS, a martyr and Apostolical Father, was born in Syria early in

the first century A.D. St. John the Evangelist appointed him bishop of Antioch in 68, and there he exercised his functions until in 107 Trajan visited the city, and endeavoured to persuade him to apostatise. On his refusal he was sent to Rome, and exposed to wild beasts in the arena. He left seven genuine epistles, and over the authenticity of others ascribed to him controversy has raged fiercely.

Ignatius Loyola. [LOYOLA.]

Igneous Rocks (also known as *eruptive rocks*, and mostly, when classified as to texture, included among *massive crystalline rocks*) form, with aqueous and metamorphic rocks, the three main groups into which all rocks are classified with reference to mode of origin. The name, suggesting origin in fire, is unfortunate, but they have all originated in the heated interior of the earth, and have consolidated by cooling from a molten, or at least pasty, condition.

In this respect they may be subdivided into three series—plutonic rocks, lavas, and tuffs. *Plutonic* or *hypogene* rocks are those that have consolidated far below the surface, and consequently under great pressure and at a slow rate, thus becoming very perfectly crystalline. *Lavas* are rocks which, having been poured out by volcanic action, have cooled at or near the surface, and therefore comparatively rapidly and with imperfect crystallisation, being sometimes glassy, sluggy, or, as it is termed, *vitreous*. This group of volcanic rocks, however, passes by gradations into the plutonic series, some of the more compact, massive, and crystalline lavas that occur in thick sheets being formerly separated as an intermediate group known as *trap* or *trappae* rocks, from the Swedish *trappa*, a stair, from their step-like outcrops. *Tuffs* are fragmentary volcanic rocks, formed by the dust and scoria of volcanoes, fragments blown from molten lava by explosive action, cooled separately, generally with a texture vitreous rather than crystalline, and sometimes compacted into a cement-like sedimentary rock, such as the black volcanic mud now accumulating in the Bay of Naples.

Chemically, igneous rocks consist of silicate of alumina, with smaller proportions of silicates of magnesia, lime, potash, and soda, usually with some oxide of iron and phosphate of lime, and with or without an excess of free silica crystallising as quartz (q.v.). From this point of view we obtain the most satisfactory primary grouping of the massive members of the group (i.e. the plutonic rocks and lavas), based mainly upon the percentage of silica (formerly known as silicic acid) which they contain, into four sections, acid, intermediate, basic, and ultra-basic. *Acid* rocks contain more than 66 per cent. of silica, some of which occurs as quartz, and their specific gravity is about 2·5; the *intermediate* rocks range in silica percentage from 55 to 65, but are without quartz, and have a specific gravity of about 2·6; the *basic* rocks contain 46 to 55 per cent. of silica, with considerable percentages of magnesia, lime, and iron, are heavy, having a specific gravity of 2·7 to 3, and are readily fusible; and the *ultrabasic* rocks contain less than 46 per

cent. of silica, and have a specific gravity generally exceeding 3.

Mineralogically igneous rocks consist mainly of felspar (q.v.), orthoclase felspar with quartz being characteristic of the acid section, but only plagioclase occurring in the basic section, and no felspar at all, as a rule, in the ultra-basic. Hornblende (q.v.) is characteristic of the intermediate section, associated either with orthoclase or with plagioclase. Augite (q.v.) and olivine (q.v.), associated with the more basic felspars, such as labradorite, with magnetite, ilmenite, and often apatite, characterise the basic section; and olivine, pyroxenes, magnetite, and chromite, without felspar, characterise the ultra-basic. In some few cases felspar is replaced by nepheline, leucite, olivine, or serpentine.

The acid section includes the crystalline granites, eurites, felsites, and liparites, the latter being always volcanic, and the glasses obsidian, pitch-stone, perlite, and pumice. The intermediate section comprises the plutonic syenites and diorites, and the volcanic trachytes, andesites, and phonolites. The basic section includes the basalts, diabases, and gabbros; and the ultrabasic, the peridotites, picrites, and serpentinites. Most of these rocks are separately described.

Ignis Fatuus (Lat. "foolish fire") is an appearance of a flickering light seen after sunset in churchyards and over marshes. Descriptions vary a great deal, and no satisfactory explanation of the phenomenon has yet been given. The light is generally of a blue-green or yellow colour; it may remain steadily in one spot; it may bound about and rise some feet into the air, or it may recede as the observer approaches it. Perhaps in some cases luminous insects or the phosphorescence of other animal or vegetable matter has produced the effect. Although marsh gas is inflammable, and is readily given off in marshy ground, it does not take fire at all readily, and is not likely to offer the best explanation. Phosphoretted hydrogen is possible; it is spontaneously inflammable, but its smell when burning is characteristic and could scarcely pass unnoticed. An inflammable phosphorescent vapour would explain many of the strange movements, but none is known excepting that of phosphorus itself, and this does not occur free. The folklore of the Jack-o-lantern, the Will-o-the-wisp, etc., which are the popular names of the ignis fatuus, is very extensive and interesting.

Igorrotes (IGOLOTS), the largest and most powerful of all the semi-independent Malay peoples of Luzon (Philippine Islands), where they occupy the hilly districts in the provinces of Benguet, Lepante, Tiagan and Bontoc. Very few are now found in their original home, the Benguet valley, since the sanguinary wars of 1820 and 1830, which resulted in the conquest of a great part of those fierce wild tribes. Type—very short muscular figures, 4 feet 8 inches high, clear olive-brown or yellowish complexion, thick black, lank, and lustreless hair, prominent cheek-bones, large black and slightly oblique eyes, which has been attributed to a strain of Chinese and even Japanese blood. The Igorrotes, who wear a kind of blue (white for

mourning) cotton or bast plaid wrapped twice round the body, live in wretched pile hovels, grouped in large villages. Formerly they were ferocious head-hunters, drinking the blood of their victims and celebrating the return of successful raiders with frightful orgies. The conquered and settled tribes are mostly nominal Roman Catholics, but the rest are all heathens whose religion is essentially a system of ancestry-worship. Spanish writers often apply the term *Igolot* in a general way to all the wild tribes in the hilly northern parts of Luzon; hence the vague meaning acquired by this word in ethnological works. (Fr. Blumentritt, *Ethnographie der Philippinen*; Semper; Schneidnagel, *Districts de Benguet*, 1870.)

Iguana, a genus of tree-lizards, with five species from the Antilles and South America, the type of a family (*Iguanidae*) with fifty-six genera, from the Neotropical region. They feed on leaves, fruit, and, to some extent, on insects. In the type-genus there is a pouch under the throat, and a row



IGUANA.

of spines extending from the neck to the tip of the tail. The common Iguana is green in colour and from 3 feet to 5 feet long; its eggs and flesh are used for food. It enters the water readily, and swims with ease, using the long tail as a propeller. To this family belong *Amblyrhynchus* (the marine lizard described by Darwin), *Phrynosoma* (the Horned Toads), and *Basiliscus* (the Basilisks).

Iguanodon, a genus of Dinosauria (q.v.) belonging to the subdivision Ornithopoda (bird-footed), which have been found in the Upper Jurassic and Lower Cretaceous rocks of south-east England and Belgium. They rivalled the elephant in size, being upwards of 30 feet long and having a thigh-bone as much as 5 feet in length. Their front limbs were much smaller than the hind ones, and these latter show marked affinities to those of the ostrich-like birds. Their feet were three-toed, and, judging from their footprints, they seem to have walked almost entirely on their hind legs. There was a long and massive tail, adapting the

animal for sitting up, as do those of the kangaroo, the megatherium (q.v.), or the woodpeckers. The teeth resemble those of the iguana of the present day, being in distinct sockets, curved, leaf-shaped, and serrated along the margin; but they are ground down above like the grinders of mammals, and were succeeded by others from below. The front of the jaws was toothless and beak-like. *Iguanodon* was very imperfectly known until the recent discovery of twenty-four extremely perfect specimens at Bernissart in Belgium, in detached pockets of Wealden strata. Several of these are now mounted in the Brussels Museum. They were undoubtedly purely herbivorous animals.

Ikongo, a people of south-east Madagascar, south of and akin to the Tannas and, like them, nominally subject to the Hovas of the province of Betsileo. But they have never been conquered, and during the wars of King Radama, in the first quarter of the 19th century, they successfully sustained two sieges—one of 18, the other of 12 months—in their impregnable stronghold perched on an isolated eminence in the heart of their territory. The Ikongs, though pagans, were friendly to the missionary Shaw, who visited them in 1871-75.

Ile de France. [MAURITIUS.]

Ile de France, a name given to that district of France which is enclosed between the rivers Marne, Seine, Oise, Aisne, and Ourcq. The ancient province which bore the name comprised large tracts beyond this circumscribed area. Except at the close of the Carlovingian dynasty, the Ile de France has usually been a royal domain. The province is now divided between the departments of Seine, Seine-et-Oise, Seine-et-Marne, Oise, Aisne, Loiret, and Nièvre. It is interesting to historians as the cradle of the Capetian dynasty, and to some extent of the French name, and because Paris was its capital.

Ilfracombe, a market-town and port in North Devon, 11 miles N.W. of Barnstaple, and at the mouth of the Bristol Channel. Some export trade is done in ore, corn, and other products, and fishing provides a livelihood for many of the inhabitants. Of late years, however, Ilfracombe has been better known as a fashionable watering-place. The parish church dates from the 12th century. The natural harbour has been improved by a pier and a lighthouse, and there is daily steam communication in the summer with Bristol and other ports, access by land being afforded by the South-Western and Great Western Railways. Pop. (1901), 8,567.

Iliyats (*il* or *eil*, "tribe"), a collective term applied in Persia to all nomad and pastoral peoples irrespective of their nationality, and in contradistinction to the settled agricultural and urban populations. Hence there are *Aryan Iliyats* (Kurds, Luri, Baluches), *Turki Iliyats* (Turkomans), and *Semitic Iliyats* (Arabs). But all alike are distinguished by their warlike spirit, conservative habits, and national, or at least tribal, sentiment. Since the decay of the old Iranian (Persian) elements, the Iliyats form the backbone of the State, and the chief source whence the government

draws its levies. For over 1,000 years they have dwelt in the land, keeping mainly aloof from the sedentary Persian inhabitants, preserving their nomad usages, tribal genealogies, and national speech, although most of them now understand the Persian language. The Ilyats are, in fact, the dominant people, the reigning dynasty being members of the Kajar (Turkoman) tribe. In recent years some have abandoned the pastoral life. Hence the two-fold division—*Shahr-nishin*, "town-dwellers," and *Sahr-nishin*, "country dwellers."

Ilkeston, a market-town of Derbyshire, on the Midland Railway, 10 miles N.E. of Derby. It stands on the crest of a hill commanding a fine view over the Erewash valley, and became a centre of local trade in the middle of the 18th century. Part of the parish church (Norman and Early English) dates from the reign of Stephen. Hosiery, especially of silk, and stoneware are the chief manufactures. Coal and iron are worked in the neighbourhood. Of late years many visitors have been attracted by the alkaline mineral springs, the water of which is beneficial to the gouty and rheumatic. Pop. (1901), 25,383.

Ille-et-Vilaine, a department in the N.W. of France, forming part of the ancient province of Brittany. It is bounded N. by the sea and the department of La Manche, E. by Mayenne, W. by Morbihan and Côtes du Nord, and S. by Loire-Inférieure. It has an area of 2,597 square miles, mostly level with occasional marshy patches, besides the rivers from which it takes its name, there are the Airon, Rance, Meu and Seiche, all more or less navigable. St. Malo is an important seaport and Rennes is the capital. The soil is not very fertile, but wheat and other cereals, hemp and flax, potatoes, and apples and pears are grown with success, the cider of the country being highly esteemed. Cattle and horses thrive well, but sheep are not abundant. Iron, silver-lead, zinc, granite, slate, and flints are a source of considerable wealth. Leather, sail-cloth, salt, glass, paper, butter, and cheese constitute the principal industrial products.

Illegitimacy. [BASTARD.]

Illinois. 1. One of the United States of North America, situated between Wisconsin N., Indiana and Lake Michigan E., Kentucky S., and Missouri and Iowa W. Originally a French colony, it was ceded to Great Britain in 1763 and remained a part of the North-West Territory from 1787 to 1818, when it was admitted to the Union. It has an area of 56,650 square miles, the greater part consisting of flat or rolling prairies, but in the south and along the rivers, of which the Wabash, Ohio, and Mississippi are the chief, luxuriant forests abound. The soil is generally rich, and almost all products of a temperate climate grow readily. Wheat and maize are yielded in vast quantities by the treeless plains where no serious failure of the crop is ever known. The forests provide food for countless herds of swine. Coal is found throughout the state, and iron and copper being easily imported from Lake Superior, a great manufacturing industry

has been developed during the last twenty-five years. Lead exists in apparently inexhaustible quantities, and the Lemont marble, a fine building-stone, furnishes material for the adornment of the handsome cities, of which Chicago is the greatest, though Springfield is the seat of the State government. The railway system is more fully developed in Illinois than in any other state, for not only do all the great trunk lines connecting the Atlantic with the Pacific, and the Mississippi Valley with Canada, radiate from this point, but scarcely a single settlement is so far as 10 miles distant from a station. Moreover, inland navigation by means of the many rivers, the Illinois and Michigan canal, and other channels, enables the producer to bring his goods into the market at a very cheap rate. The educational and charitable organisations are liberally maintained, and 75 per cent. of the population between the ages of six and twenty-one are registered as attending schools.

2. An old aboriginal people of North America, mentioned by the early French explorers, but now extinct, or surviving only in the name of the river and of the state where they roamed. At the time when Cavelier de la Salle was exploring the Mississippi basin (1670-82) they occupied both banks of the Illinois and apparently also the northern shores of Lake Michigan, which La Salle always speaks of as the *Lac des Illinois*. This term is a French form of *Ilinivok*, which means "men," "people," in several Algonquian languages, a clear indication that they were a branch of that widespread family. Comp. the *Ininiwok* of the Salteaux Indians and the *Iyiniwok* of the Kree people.

Illiterates, persons unable to read or write, or able to read but not to write. Various methods have been adopted for ascertaining the proportion of illiterates in a country to the whole population with the view of gauging the progress of education. In some countries an attempt has been made to take a general census; the result given ranged from 10·7 per cent. in the United States to 78·8 per cent. in Portugal. In Germany, in 1904, the proportion of illiterates among the recruits was 0·4 per cent. The highest proportion was that of East Prussia, 15 per cent. The progress of elementary education in England and Wales is shown by the decreasing proportion of persons signing the marriage registers by mark. In 1843, 32·7 per cent. of males and 49·0 per cent. of females married within that year signed in this manner; in 1905, 1·6 of males and 2·0 of females. In Scotland, in 1905, 2·17 per cent. of males and 1·61 of females signed by mark; in Ireland, in 1906, 8·6 per cent. of males and 6·2 of females. In estimating these various results, it must be remembered that as they are obtained by very different means, the data for forming a comparison are not very satisfactory.

Illuminati, "the Enlightened Ones" (1), a name adopted by several mystical sects who maintained that they had received a special revelation or possessed a more intimate knowledge of holy things than was granted to the mass of mankind. The most important were the *Aiombados*, who arose in Spain early in the 16th century, and were finally

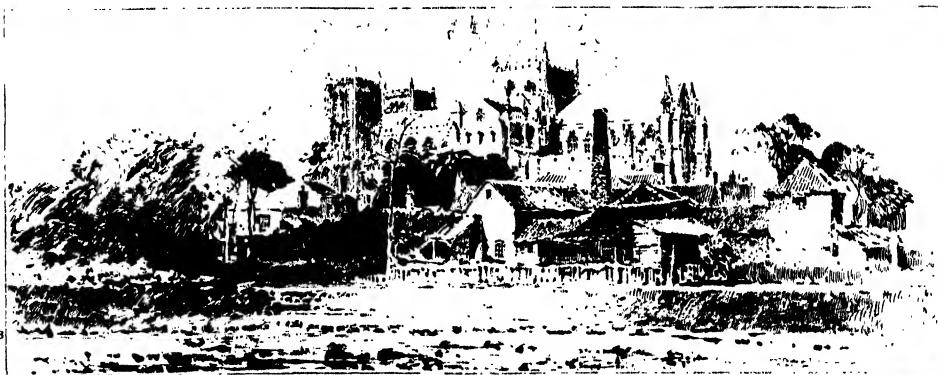


ILLUSTRATION.

1. PORTRAITS REPRODUCED BY PHOTOGRAPHIC PROCESS:
(a) FINE SCREEN TONE FOR GOOD PRINTING. (b) PEN AND INK DRAWING. (c) OPEN SCREEN TONE FOR NEWSPAPER PRINTING.
2. DRAWING REPRODUCED BY WOOD ENGRAVING.
3. PEN AND INK DRAWING REPRODUCED BY PHOTOGRAPHIC PROCESS.
4. PHOTOGRAPH REPRODUCED BY HALFTONE PHOTOGRAPHIC PROCESS.

suppressed by the Inquisition, and the *Guerinets*, a French sect founded by Antony Buckner about a century later. (2) A semi-religious, semi-political association, founded in 1776 by Adam Weishaupt (1748–1830), professor of canon law in the university of Ingolstadt. Its main object was to counteract the influence of the Jesuits and promote freedom of thought in religious matters, but it also endeavoured to extend republican principles. It was divided into three classes: the novices or Minervals, the Freemasons or Scotch Knights, and the pupils in the small and great mysteries. After the adhesion of Baron von Kniegge, in 1780, the number of the Illuminati rapidly increased, but in 1784 Weishaupt and Von Kniegge quarrelled, and in 1785 a persecution began which led in a few years to the total collapse of the order.

Illumination, the art of adorning MSS. and books with paintings and ornamental letters and designs. The paintings in mediæval MSS. were called miniatures from the frequent use of a red pigment named *minium*: they were necessarily very small, a circumstance which gave rise to the modern meaning of the word. Certain Egyptian papyri are extant, in which directions concerning ritual are written in red ink to render them more conspicuous (a method also employed in mediæval liturgies; hence the term *rubic*), and even coloured pictures are sometimes introduced. With this exception there are no illuminated MSS. older than the 4th century A.D. The most ancient are the *Dioscorides* at Vienna, and the *Virgil* in the Vatican; in both the ornament consists of rectangular pictures. The *Codex Argenteus* (c. 360), now at Upsala, containing Ulfila's translation of the Bible into Meso-Gothic, exhibits a different style of illuminating; here the letters are of gold and silver, and the vellum on which they are written is stained with a red-purple dye—an art the secret of which was afterwards lost. One of the most conspicuous features of the *Byzantine* style is the abundant use of gold, especially in backgrounds. Byzantine influence can be more or less clearly discerned in all subsequent styles up to the 11th century. Even the *Keltic* style which grew up in the Christian monasteries of Ireland, reaching its zenith in the beautiful *Book of Kells* (probably a work of the 9th century), is believed to have been of Byzantine origin. The Keltic MSS., however, display a skill in the minutia of draughtsmanship which is unrivalled in any other style; their most remarkable characteristic is the extraordinary intricacy of the designs, consisting usually of spirals, ribbon-patterns, and interlaced forms of attenuated animals and birds. The Keltic style was carried by the Irish missionaries to the Continent, where it united with Roman and Byzantine elements in the formation of the *Carlovingian* style, which grew up in France and Germany under the encouragement of Charlemagne. The Harleian *Codex Aureus* in the British Museum is a magnificent example of the Carlovingian period. Of the *English* style, which corresponded to the Carlovingian abroad, the finest example is the benedictional of Ethelwold, Bishop of Winchester (963–84), now at Chatsworth. The art declined owing to

the excessive care bestowed on the ornamentation of detail, whilst the writing itself was neglected. In themselves, however, the paintings in MSS. of the 14th and 15th centuries surpass those of any preceding age. The most beautiful example of this period is the *Bedford Hours* (1423) in the British Museum. During the Middle Ages the illumination of MSS. was carried on in the scriptorium attached to every monastery. It gradually died out after the invention of printing.

Illustration of Books. Before the invention of printing the illuminations (q.v.) in MSS. served the two-fold purpose of elucidating and ornamenting the text. The earliest printed books in which the text was illustrated by a series of wood-engravings are said to have been the *Fables* of Ulrich Bohner (Bamberg, 1461) and a work entitled *Meditationes* (Rome, 1467). Metal-engravings were first employed in *Il Monte Santo di Dio* (Florence, 1477). Illustrations in chiaroscuro, in which various shades of the same colour are produced by means of different wood-blocks, occur frequently in books published early in the 16th century, and are often executed with very great skill. In the early years of the 19th century lithography (q.v.) to a great extent took the place of steel-engraving in the illustration of books, but during the first half of that century steel-engraving and etching received a fresh stimulus; and many beautiful illustrations for books of an ornamental kind were produced by Turner, Stothard, and other great artists. This progress was checked through the introduction of various processes suggested by the invention of photography, one of the most artistic of these methods being that by which the photogravure (q.v.) is produced. Wood-engraving received a temporary resuscitation from the work of Bewick, who was followed by Sir John Gilbert, Birket Foster, Cruikshank, H. K. Browne, Leech, Tenniel, and others, but in recent years has been practically superseded by mechanically produced blocks. These fall into two classes—"line" and "half-tone," according as the drawings reproduced are line drawings in pen-and-ink or black-and-white on the one hand, or half-tone photographs or wash drawings on the other. The first successful attempt to produce blocks in half-tone was made by Meisenbach, of Munich, in 1882. In brief the process for producing half-tones consists of photographing a subject through a glass screen, the surface of which is broken up into a number of minute squares. The negative so obtained is printed on to a copper plate coated with bichromated gelatine, which is washed to eliminate the soluble gelatine, is then subjected to heat to harden the remaining fixed gelatine, and treated with perchloride of iron which "etches" out that part of the copper exposed by the removal of the soluble gelatine, and so produces the picture. [ENGRAVING, PHOTOGRAPHY.]

Illyria (Gk. *Illyris*, Lat. *Illyricum*), the name of a somewhat vaguely-defined country on the east shore of the Adriatic, where, according to legend, Cadmus of Thebes settled and became father of Illyrius, and so of the race or nation. Five Roman emperors had in their veins Illyrian blood.

Gradually Illyricum grew to be one of the four divisions of the empire, embracing a large share of the Balkan peninsula. On the split of the empire, it was partitioned into Illyria Romana and Illyria Græca, and later on had to bear the brunt of Gothic and Slavonic invasion until the Huns amalgamated with the original population, and the coast as far as Dyrrachium was given up in the 7th century to the Slavs, who still occupy it. The Albanians, a branch of the old Illyrian stock, pushed farther south, but Illyria as a geographical appellation ceased to exist, Bosnia, Croatia, Servia, Dalmatia, and Rascia taking its place. Narenta and Ragusa for a time enjoyed great commercial prosperity, and in 1809 a kingdom of Illyria was revived by the Treaty of Vienna, but vanished from the map after forty years.

Ilocanos, a Malay people of Luzon (Philippine archipelago), where they occupy several districts in the provinces of Pangasinan, and the two Ilocos (North and South), named from them. They have also repopulated much of the Benguet valley after the extermination of its original Igorrot inhabitants during the wars of 1820 and 1830. They are a restless, enterprising people, who have sent out colonies in all directions, and founded settlements even in the Babayanes and Batanes archipelagoes. In this respect they are favourably distinguished from the Tagalas and other civilised Indians, who are remarkable chiefly for their extreme apathy and indolence. They live mainly on rice and fish, although cultivating maize, coffee, the grape, the cocoanut palm, and sugar, besides cotton, indigo, cacao, and the olive. They also own an excellent breed of horses, as well as herds of cattle, swine, and the buffalo, which they barter with the surrounding hill tribes. Since their reduction by Salcedo in the second half of the 16th century, all have become nominal Christians. Socially they form two distinct classes, the nobles and the *cachianas*, or serfs, who were formerly treated with great cruelty, but who have acquired a measure of civil rights since the revolts of 1762 and 1811. (Blumentritt.)

Ilongotes (ILUNGUT), an independent Malay people, who occupy a large territory in the hilly northern districts of Luzon, Philippine archipelago. They are amongst the most savage tribes of this region, waging constant warfare both with the settled Christian communities and with the surrounding Negrito wild tribes. The chief object of their expeditions is the capture of human heads, with which they decorate their houses, and the possession of which gives rise to everlasting feuds amongst themselves, the different villages being constantly engaged either in defending their own or in raiding the trophies of their neighbours. A few were reduced in the province of Nueva Vizcaya about the middle of the 19th century; but the great bulk of the Ilongotes are still pagans, mainly ancestry worshippers. (Blumentritt.)

Ilori (ILORIN or ALORI), a large town in Africa, situated about 150 miles N.E. from the Bight of Benin. The inhabitants are chiefly Yorubans, and Mohammedanism predominates. A large trade is done in the bazaars, to which goods are brought

not merely from the interior, but from the Mediterranean and Guinea coasts. It has been visited by Booth, Lander, and Burton, from whom we gather that the walls have a circuit of twelve miles.

Ilyanthidae, a family of sea anemones, of which the type-genus is *Ilyanthus*; it differs from *Actinia*, the common sea anemone, by having a pointed, not basal end, and by being free-swimming.

Image, in various branches of physics, signifies strictly an objective deception of the sense of sight or of hearing. The most familiar is the reflection of objects in a mirror. Here there is an appearance of reality behind a plane sheet of burnished metal, caused by regular reflection of light coming from the actual objects in front. There are no waves of light actually proceeding from behind the mirror, and such images are termed *virtual*. Another instance is that of the formation of a small image of the sun, by proper focussing of a magnifying-glass, on a sheet of paper. Here the waves of light actually proceed from the image, which is therefore termed *real*. Echoes supply examples of both real and virtual images produced by reflection of sound waves. Analogous effects are obtainable with electric and other oscillations.

Imaginary Quantities, in algebra, signify numbers that have not yet been interpreted. The most familiar are the two square roots, positive and negative of -1 . They are symbolised $\pm\sqrt{-1}$, or $\pm i$, and by ordinary definition of square root they mean such numbers that when squared will give -1 . Now all ordinary numbers, both positive and negative, will give positive results when squared, and an entirely new region of numbers is entered when the reality of $\pm i$ is entertained. To be consistent in theory we are certain to come upon these new units, and they cannot be neglected. Moreover, the proper use of imaginary quantities often leads to real results that are not at all imaginary and that can readily be tested. It must be understood that many such quantities might be used in mathematics, if we knew how to manipulate and interpret the results obtained. Till the 19th century mathematicians had confined their investigations in number to the units ± 1 and $\pm i$. Sir William Hamilton in his system of quaternions introduced others, his set of four being $1, i, j$, and k , to the last three of which special relations were assigned, in the same way that the old i^2 was defined as being identical with -1 . [QUATERNIONS, VECTOR CALCULUS.]

Imago, the name of the adult or winged condition of the butterfly after it has emerged from the chrysalis.

Imanghasaten, a Tuareg people of the north central Sahara, members of the Azjar confederacy, although traditionally descended from the Megārha Arabs of the Wady Shiāti in Fezzan. At present they are entirely assimilated in dress, speech, and customs to the other Azjar Tuaregs, amongst whom they have their camping grounds. Since the memorable expedition of Denham, Clapperton, and Oudney (1822), the Imanghasaten have always been the friends and protectors of English explorers,

while the neighbouring Orâghen have taken the French under their protection. But for this friendly disposition of some of the Tuareg tribes no Europeans could have ever penetrated from the Mediterranean seaboard across the Sahara to Sûdan. (H. Duveyrier, *Les Touaregs du Nord*.)

Imazighen (singular, AMÂZIGH), the proper collective name of all the Mauritanian Berbers, meaning either "Descendants of Mazigh," a legendary ancestor of the Berber race, or more probably the "Free" or "Noble." This term, which is of vast antiquity, being already known under various forms (Mazyes, Machmès, Mazices, etc.) to Herodotus and other early writers, is merely a dialectic variant of *Imahagh*, *Imashagh*, the proper collective name of the Tuaregs or Saharan Berbers. In Morocco it answers to the *Shelûh* or *Shlîh* of the Arabs, although this term is now restricted to the tribes of the central districts of the Great Atlas, those of the north being more commonly known as Kabyles, like the kindred peoples of North Algeria.

Imbros (mod. *Imro*), an island in the Aegean Sea, about fourteen miles from the entrance to the Dardanelles, between Samothraki and Lemnos. It has an area of 105 square miles, most of which is covered by bare and rugged mountains. There is only one river of importance, and lack of water is a bar to agriculture. Kastro, the capital, is a mere village on the coast, Theodoroi, Gliki, and Panagia being still poorer communities. The island has formed part of Asiatic Turkey since the 15th century, and is the seat of a Greek Metropolitan, the Exarch of the Aegean.

Imeritians (IMERIANS), the inhabitants of the Caucasian province of Imeritia, which extends west of the Suram range as far as the Tzchemis-Tzchali river. *Imerian* is the correct form, meaning "People of the other side," in reference to the mountains separating them from the bulk of the Georgian race, of which they are a western branch. They are the highlanders, as opposed to the Mingrelian lowlanders of the Rion basin. All are comprised in the Russian administrative province of Kutais since 1810, when Solomon II., last ruler of the old kingdom of Imeria, was deposed by the Russians. (Carlo Serena, *Excursions dans le Caucase*, in *Tour du Monde*, 40-43.)

Immaculate Conception, a doctrine of the Roman Catholic Church to the effect that the Blessed Virgin "from the first moment of her conception in the womb of her mother was preserved free from all taint of original sin." The doctrine can be traced back in a vague form to an early period, but it was never distinctly stated before the 12th century. In 1140 St. Bernard of Clairvaux addressed a remonstrance to the canons of Lyons cathedral because they had introduced a festival in celebration of the doctrine without episcopal sanction. Early in the 14th century the doctrine was upheld by the Franciscan schoolman, Duns Scotus, and its truth and falsehood became a matter of keen controversy between his order and their Dominican opponents. The University of Paris generally supported the view of the Franciscans,

and in 1439 the doctrine was recommended as a "pious opinion" by the Council of Basel. In the same council the 8th Dec. was set apart for the celebration of the "Feast of the Immaculate Conception." The matter continued to be more or less warmly debated during the following centuries, but in 1544 it was settled by the publication of the Papal Bull "Ineffabilis Deus," which made the dogma an article of the Catholic faith.

Immermann, KARL LEBERECHT, was born at Magdeburg in 1796, and was a law-student at Halle when "the Hundred Days" brought a renewal of war. He joined the Prussian ranks, fought at Ligny and Waterloo, and on his return received a judicial post at Düsseldorf. Under the influence of Countess Ahlefeldt he devoted his leisure to literature and to the vain attempt to elevate the national drama. His tragedies, though rugged, show power of characterisation, and his comedies are by no means devoid of humour. More popular were his romances, especially *Die Epigonen*, and his miscellaneous writings, which include a translation of *Iranhoe*. His platonic alliance came to an end in 1839, when he married a granddaughter of the Chancellor Niemeyer, but he died in the following year.

Immigration and Emigration. An emigrant is one who leaves his native soil to settle in a colony or foreign land; an immigrant is a newcomer, whether alien or connected by blood with the people among whom he arrives. Thus he who is an emigrant at one end of his journey becomes an immigrant at the other, and although the two movements are perfectly distinct as long as attention is confined to a single country, their mutual relations are so close that the one can seldom be fully understood without some reference to the other. The range of inquiry opened up by the history of emigration and immigration from the beginning of history to the present time is practically boundless, and all that will be done here is to give some account of the state of the two movements in Great Britain at the present time. The increase which has taken place in emigration within ninety years is shown by the fact that in 1815 only 2,081 emigrants left the country, whereas in 1909 the number was 474,460. Of this total 145,630 were bound for places within the British Empire, and 143,238 for foreign countries; and 282,600 were natives of Great Britain and Ireland, 6,250 were British Colonials, and 185,600 of foreign origin. State-aided emigration is now much advocated. From 1815 to the end of 1909 a total of 16,063,282 emigrants have left United Kingdom ports. Two schemes were devised in 1902. The first was the work of the late Hon. John Robson, Premier of British Columbia, who submitted to the Imperial Parliament a plan for transporting some 1,200 families of Scotch crofters to Vancouver Island, where facilities would be afforded them for engaging in the fishing trade; for this purpose the British Columbian Government was to receive from Parliament a loan of £150,000. In September, 1892, it was announced by the Government of Western Australia that, in accordance with the "homestead free grant" system, they were willing to grant

plots of land, not exceeding 160 acres each, besides advancing £150 to settlers from the public money. In the Australian and other colonies there is more opening for agriculturists and farm labourers than for professional men and artisans, the colonies being able to supply as many of the latter as they require. The increase in the number of emigrants from the United Kingdom of British origin in 1909 was 25,666, whereas the increase in the total number was 88,047. This fact confirms the view that the greater number of the pauper aliens, whose arrival in the country within the last few years has created so much panic, had no intention of settling here. This is confirmed by the fact that out of 342,920 alien immigrants in 1908, only 43,489 remained in this country. They are mostly Russian and Roumanian Jews, who have been driven abroad owing to the hard conditions existing in their own country. They generally embark at the ports of North Germany, and, when they arrive in this country, are almost always in a state of complete destitution. The severe restrictions imposed by the United States Government on immigration has resulted in a considerable diminution in the number of those who find a home beyond the Atlantic. This may cause increased immigration into England, although, perhaps owing to the outbreak of cholera at Hamburg and elsewhere, which checked the movement for a time, no very serious "invasion" has hitherto taken place. In the preceding account it has been assumed that the immigration is *per se* an evil; but this is denied by some who are well qualified to form a sound judgment on its practical results. These authorities contend that, far from driving down wages to starvation point, and lowering the quality of work in the cheap cabinet-making, boot-finishing and other trades, the strangers have absolutely created some new industries. It is also asserted that the descriptions of their colonies in East London and elsewhere as centres of physical and moral contamination are very much exaggerated. An Aliens Act was passed in 1905 with a view to checking the immigration of undesirable aliens, and it came into operation on Jan. 1, 1906.

Immortality. Although a belief in a future life of some kind is found amongst even the most savage races, and may almost be said to belong to the consciousness of humanity, the notion that the soul is immortal is a refined conception which does not make its appearance till a comparatively late stage in the progress of civilisation. Some critics maintain that no distinct notion of an eternal life can be traced farther back than the Babylonian captivity; whilst Balaam's prayer (Numbers xxiii. 10) and various passages in the Psalms of David, as well as the whole tenor of their hopes and aspirations, are brought forward in support of the opposite opinion. It is also held that our Lord's words in Matthew xxii. 29-33 show that there had been a revelation of the immortality of the soul even in the days of the Pentateuch. In the ancient religion of Egypt the immortality of the soul was supposed to depend on the preservation

of the body, and for this reason corpses were embalmed and entombed with great care. The realm of Ormuzd seems in many respects to have occupied in the ancient religion of Persia the same position which in that of Egypt belonged to the region where the just dwell for ever with the god of light. In Greece the belief in the immortality of the soul was the outcome of philosophic speculation. It was firmly held by the Platonic Socrates, who in the *Phædo* expresses his conviction in the most beautiful and glowing language. The Platonic doctrines became known to the Hellenistic Jews of Alexandria, and their influence has been traced in Ecclesiasticus, Wisdom, and other books of the Apocrypha. But in Greek philosophy the freedom of the soul from the limitations of matter is presented from an intellectual rather than a religious point of view, and it was only with the Christian revelation that it became recognised as the crowning-point in the moral scheme of the universe.

Immortelle. [EVERLASTING FLOWERS.]

Imohagh, collective name of the Tuaregs of the north central Sahara, comprising the eastern Azjars and the western Ahaggars, who were formerly united under the rule of the Imanán Sultans, but who, since the middle of the 17th century, have been constituted in two separate and independent confederacies. *Imohagh* is radically the same word as *Imoshagh* (q.v.). (J. Richardson, *A Mission to Central Africa*, 1855; F. Bernard, *Quatre Mois dans le Sahara*, 1881.)

Imoshagh (singular, AMOSHAGH), the "Free" or "Noble," collective name of the south-western Tuaregs, often applied in a general way to all the Saharan Berbers. [TUAREGS.] The Imoshagh, who are the Limtūna (Lamtūna) of mediæval Arab writers, form four distinct groups of independent confederate tribes, who are carefully to be distinguished from the *Imghad* (plural of *Anghi*), that is, the degraded or mixed Berbers of the desert, mostly living in a state of servitude to the Nobles. The four great historical groups are:—(1) The *Awelimmiden* proper, with twenty-two main divisions, besides forty servile and five religious tribes (Marabouts), jointly occupying most of the southwest Sahara, as far south as Timbuktu and the great northern bend of the Niger. (2) The *Awelimmiden-Wān-Bodhal*, called also *Dinnik*, greatly reduced, and now mainly confined to the district between the Niger and Asben (Air), where they form a petty independent state in alliance with the Kel-Gueres. (3) *Tademekket*, also reduced and driven by the Awelimmiden to the districts of Azwād north of the Niger and to the tract within the Niger bend as far south as the Hombori Hills. The latter, collectively called *Irighenaten* ("Mixed"), have quite lost caste, many having contracted alliances with the Fulahs and Negroid Songhays, whose speech they have even in some cases adopted. To this group are attached four religious and eight servile tribes. (4) The *Igweldā*, a religious group dependent for their defence on the Tademekkets, and settled chiefly in Tagānet between Azwād and Timbuktu north and south. The

Imoshagh, of whom there are altogether at least a hundred minor divisions, are all pastoral, raising large herds of camels, cattle, and horses. The warriors fight on horseback with lance, sword, and shields, and generally levy blackmail on all trading caravans passing through their territory. All wear the lintham or veil, concealing a great part of the face, originally as a protection against the sands of the desert, but now regarded as a sacred emblem never to be laid aside, even at night. (Barth, *Travels*, vols. iv. and v. *passim*).

Impact, in dynamics, signifies a sudden interchange of the amount of motion of two bodies which meet. One of the bodies may be at rest, as when a hammer strikes a chisel. In this case the momentum of the hammer-head seems to be entirely lost, but actually it is transmitted through the chisel to the bodies with which the chisel is in contact. Or the two colliding bodies may both be in motion and out of contact with others. In this case the fact that the total momentum is unchanged by impact may be much more readily proved experimentally. It must be remembered that the momentum of a body is measured by the product of its mass and its velocity, and that the momentum becomes of opposite sign algebraically when the direction of motion is reversed. Whether bodies are elastic or inelastic, i.e. whether they cling together after impact and so move as one, or whether they are separated by the internal forces of restitution that tend to make the distorted bodies recover their original shape—the same law holds good that the momentum of the whole system is unaltered by such an action. This may be inferred from Newton's Third Law of Motion. [DYNAMICS.] But the degree of elasticity possessed by the colliding system will determine their relative speeds after impact, when the bodies are not inelastic, and will settle the distribution of momentum. The relative speed after impact is always less than before; kinetic energy is, in fact, lost as such and converted into heat, for the bodies are always warmer after such an interchange of momenta. The fraction of the original value, by which the relative speed is reduced, is called the coefficient of restitution, and is a measure of the mutual elasticities of the substances.

Impeachment, a complaint or accusation against anyone for a great public offence, especially against a Minister of the Crown for malversation or treason. The House of Commons first finds the crime and then, as prosecutors, support their charge before the House of Lords, who try the question and adjudicate upon it. The charge is contained in Articles of Impeachment, to which the accused makes answers. The Commons appoint managers to conduct the proceedings on their behalf. The last memorable cases were those of Warren Hastings in 1788 and Lord Melville in 1805.

Imperforata, a group of the Foraminifera including all those with imperforate shells. It is now recognised that this character does not possess the value once assigned to it, and the group has been abandoned. [FORAMINIFERA.]

Imperial Green, also known as *emerald green*, consists of the double arsenite and acetate of copper. It has a fine green colour, and is a very permanent pigment, being unaffected by exposure to the atmosphere, but possesses the disadvantage of being of a very poisonous nature.

Imperialism is a term which may be used with a great variety of meanings, according to the circumstances under which it is applied. As used of modern Germany, it denotes the union of several distinct States, under a single ruler, who forms, as it were, a focus for the national feeling, and is able to give effect by his policy to the national aspirations. It was probably partly with the view of fostering such a feeling, as well as of overawing the Indian population, that Lord Beaconsfield had Queen Victoria proclaimed Empress of India. A similar notion underlies the aims and is expressed in the title of the "Imperial Federation League" and the "Imperial Institute"—viz. that England should remain the centre and rallying-point of the various branches of the Anglo-Saxon race, which, however widely sundered, retain the ties of a common race and language, political and social institutions, etc.

Imperial, Prince. [NAPOLEON.]

Impey, SIR ELIJAH, KNIGHT, was born at Hammersmith in 1732, and educated at Westminster and Cambridge, where he took high honours. In 1774 he was sent out to Bengal as first Chief Justice under the new Regulating Act, which imperfectly defined his jurisdiction. On his arrival the quarrel between Warren Hastings and Nuncomar had reached its culminating point, and the latter was brought to trial before Impey on a charge of forgery, and was convicted and hanged. Sir P. Francis accused the judge of unwarrantably extending his jurisdiction and of great harshness and injustice towards the prisoner. These aspersions were confirmed by the decision of Impey in favour of Hastings in the dispute as to his resignation, and by the unjustifiable way in which he mixed himself up in the affairs of Chait Singh. He was recalled in 1786, and defended himself at the bar of the House of Commons with such effect that the motion for his impeachment was rejected. In 1789 he resigned and, entering Parliament, sat for New Romney until 1796, but took no part in public affairs. He died at Newick, in Sussex, in 1809. Sir J. F. Stephen has recently vindicated his memory from Macaulay's attacks.

Impeyan Pheasant (*Lophophorus Impeyanus*), sometimes known by its native name, Monaul, from the Himalayas and Assam. The dark plumage of the male has a brilliant metallic gloss of varying hues, and he has a peacock-like crest. The popular and specific names refer to the fact that Lady Impey tried, unsuccessfully, to domesticate the bird in England. It has, however, bred in confinement.

Impressionism, a school of art which has grown into importance since the exhibition of the works of Manet and his disciples held in Paris in 1867. The whole theory and practice of the Impressionists are based on a single principle—viz.

that the artist should aim merely at producing a faithful record of the *impression* made on his own mind by the scene or object he depicts. This he will fail to do if he allows himself to be guided by the traditions of previous schools, or if his rendering of sensuous effects is dominated by some ulterior purpose of a moral, imaginative, or emotional character. There is no reason even why, in his choice of subjects, he should discriminate between the beautiful and the ugly, since this is a conventional and arbitrary distinction for which there is no warrant in Nature herself. From the preceding account it will be seen that Impressionism occupies much the same place in the history of modern art that Realism does in that of literature. Its chief exponent in England was J. McNeill Whistler, but it is now represented by an even more advanced group, whose works are to be seen at the New English Art Club Exhibitions, or at those of the International Society of Painters, Sculptors, and Gravers.

Impression, the legalised compulsion of a man to serve in the Royal Navy. The practice of impressment is of very ancient date in England, and though it is naturally odious, and has for many years been disused, it may in war-time be again revived. It seems to have been first formally legalised by an Act of 2 and 3 Philip and Mary.

Imprisonment. By the Debtors' Act 1869 imprisonment for "making default in payment of a sum of money" has been abolished except in certain specified cases, of which the more important are—default in payment of a penalty, not in respect of contract, default in payment of sums recoverable before a Justice of the Peace, and default by trustees or solicitors after order to pay; but in such cases the duration of the imprisonment is not to exceed one year. The above Act, however, gives any court a power of committal on default of payment when the party has the means of paying, and if the court be an inferior one when the debt does not exceed £50, but no such committal is to operate as a satisfaction or extinguishment of the debt.

Improvisation, the act of employing the revenues of a church living for a layman's use, and it exists where a rectory or tithes are held by a lay person termed the improvisor. In the case of a rectory the improvisor or lay rector is bound to provide for the cure of souls by appointing either a vicar or a perpetual curate for the purpose.

Improvisatori and Improvisatrices, a class of Italian poets and poetesses who possess the gift of immediately composing verses on any subject proposed, often singing and playing on the lute or some other instrument at the same time. The art is said to have been invented by Petrarch, and the Italians often amuse themselves in this manner at the present day.

Inamis (ENIMAS), South American aborigines, a branch of the Guaycuras, whose territory lies between the Paraguay and the Pilcomayo rivers east and west. They are the *Lingos* of the Portuguese, and the *Longuas* of the Spaniards, these words meaning "tongue," in reference to the

tongue-shaped wooden ornament which they attach to the under lip. The Inamis had formerly the reputation of being the most warlike and predatory of all the Gran Chaco Indians; but in recent times they have entered into friendly relations with the Brazilians, to whom they supply horses in exchange for cattle. (V. de Saint-Martin.)

Inarticulata, the division of Brachiopoda (q.v.) in which the two valves of the shell are not united by a hinge. It includes the five small families of the *Lingulidae*, *Cranidae*, *Discinidae*, *Obolidae*, and *Trimerellidae*, of which all but the first two are extinct. The name is synonymous with Treterata, which is now more fashionable.

In articulo mortis, a legal phrase indicating a person's being at the point of death. [WILL.]

Incandescence, the condition of a body when, by reason of its temperature, it emits white light. As the temperature rises the molecular motions become more rapid and give rise to waves in the surrounding medium of greater frequency. At a temperature of about 400° C. the waves emitted are of sufficiently high frequency to have a slight effect upon the eye. The substance then appears of a faint grey colour, which changes to dull red, bright red, orange, yellow, white, and violet, as the temperature is continually raised. A substance at violet-heat, like the sun, is not only giving out violet light, but also light of all colours corresponding to a lower temperature—a fact that is proved by the ordinary experiment of analysing sunlight with a glass prism. High temperature is not alone sufficient to produce brilliant incandescence; a pure hydrogen flame is almost colourless, but it will easily render platinum wire white-hot. The electric arc is much less brilliant than the glowing carbon poles, though at a much higher temperature. In fact, the presence of solid matter is almost essential; not always so, as the incandescent air of a flash of lightning proves. *Incandescent lamps* have specially-prepared filaments, carbonaceous or metallic, enclosed in glass vessels from which the air has been removed as effectually as possible. The ends of the filaments are connected to two terminals on the outside of the lamp by means of platinum wires passing through the glass, and a current of electricity is sent through the lamp by connecting up the circuit with the terminals. The high resistance of the lamp causes a great rise of temperature of the filament, which quickly becomes incandescent. If there be air inside the lamp the filament will burn away. If the current is too strong the temperature becomes extreme and the filament bursts. A body may give out light without being at a high temperature itself; a glowworm is an example of such a body, but the explanation of this and of a few similar exceptional cases has not yet been given. *Incandescent Gaslight*.—This is produced from ordinary house gas, by means of a specially constructed burner, part of which consists of a "mantle" which becomes incandescent when the gas is lit. The general principle is that the gas, being emitted through a metal gauze to the inner area of the conical mantle, percolates through the mesh of the mantle, and when a light

is applied produces an intense white luminant of considerable penetrative power. The mantle is woven from thread obtained from the Chinese ramie grass, and when complete is dipped into a solution of thorium nitrate (99 per cent.) and cerium nitrate (1 per cent.), according to the process invented about 1885 by Baron von Welsbach.

Incandescent Gaslight; Incandescent Lamps. [INCANDESCENCE.]

Incantation, a charm or magic formula, supposed to be efficacious in itself, or recited or sung to add force to magical ceremonies. It is a common belief that incantations are relics of a vanished faith, or remnants of a learning handed down from remote antiquity, while the body of knowledge of which they formed part has long ago disappeared. The occult writings of the Middle Ages are too mystical to be of much service to the general reader. The poems of Theocritus, Virgil, and Horace furnish us with admirable examples of the use of incantations. By their means sorcerers claimed to be able to command the powers of Nature, to bring down the moon from heaven, and turn back rivers in their courses; to compel the attendance and service of supernatural beings (*cf.* 1 Sam. xxviii. 7-14) [FAUST, MAGIC]; to influence the affections, and to inflict or cure physical injury or disease.

Incense ("that which is burnt," Lat. *incensum*), the perfume which arises from burning certain resins and gum-resins. Etymologically the word should denote the substance which is burnt, and this meaning survives in *frankincense* (q.v.)—i.e. "the true incense," from Old French *franc*. Frankincense was so called because, being the aromatic most easily obtainable from the East, it came to be the only one used for purposes of ritual and fumigation. In the preparation of incense it is now usually mingled with styrax, benzoin, and powdered cassarilla bark. The use of incense is frequently mentioned in the Old Testament, and many existing monuments show that this rite was included in the worship of the ancient Egyptians and Assyrians. From the fourth of the Apostolic Canons it is evident that incense was burnt in the services of the Primitive Church. It is used in the Roman Catholic Church at the Introit, the reading of the Gospel, the offertory, and the Elevation at High-Mass, also at the Magnificat and at funerals. Its use, which was discontinued in Protestant countries at the time of the Reformation, has been revived in a few cases by the so-called "Ritualist" party in the Church of England, but its ceremonial use during the Communion Office has been declared illegal. Incense, though specially applied to frankincense (q.v.) as the only genuine or "franc" incense, is a general name for aromatic substances, mostly vegetable resins and gum-resins, which are burnt for their fragrance, generally as a religious ceremonial. Though largely sanitary in origin, especially when used at funerals or in conjunction with the slaughter and burning of animal sacrifices, its use may have been from very early times connected with the general notion that smoke ascended spontaneously heavenward and that "a sweet

savour" was pleasing to the Deity. Among the Jews apparently sometimes frankincense was used alone, and at others a compound known as "ketoreth." This consisted of equal parts of frankincense, stacte, onycha, and galbanum (*Exodus xxx. 34*). Stacte was probably the gum or storax (q.v.) of *Styrax officinale*, native to the Levant; onycha was the operculum or small shell on the foot of a species of wing-shell (*Strombus*); and galbanum (q.v.) the gum of the Syrian *Galbanum officinale*.

Incest, the sexual intercourse of persons within the Levitical degrees of kindred. It was during the Protectorate a capital offence, as was also adultery, but at the Restoration this law was not confirmed, and these offences were then relegated to the jurisdiction of the spiritual courts, which determine what kind of sexual connection is incest. The notion of incest is entirely founded upon the consanguinity or affinity of the parties.

Inchbald, MRS. ELIZABETH, the daughter of a farmer named Simpson, was born at Standingfield, Essex, in 1753. Her father died when she was eight, and though poverty prevented her receiving a regular education, she and her sisters cultivated a regular education, she and her sisters cultivated of their own accord literary tastes and domestic sympathies. In 1772 she came to London secretly, and tried to get a theatrical engagement in spite of an impediment in her speech. Mr. Inchbald, an actor at Drury Lane, made her his wife, and for six years they played together in the provinces. On his death, in 1778, she remained for a time on the stage, but her success as a dramatist enabled her to retire in 1789. Among her successful plays were *Wives as They Were and Maids as They Are*, *The Married Man*, *The Wedding Day*, *Lovers' Vows*, and *The Midnight Hour*. Her two romances, *A Simple Story* and *Nature and Art*, still find readers, and her *British Theatre*, *Modern Theatre*, and *Collection of Farces* are standard compilations. She destroyed her autobiography before her death, but Boaden's *Memoirs* give a full account of her life, which ended in 1821.

In Cœna Domini, a Papal bull, originally promulgated in the Middle Ages, which received its final form from Urban VIII. in 1627. It was so called because originally it was read on Maundy Thursday, the day of the "Supper of the Lord." It contained a summary of the claims of the Roman Church, and excommunicated those who infringe her rights or dispute her doctrines. Clement XIV. discontinued its publication in 1773.

Income Tax is a tax on the yearly profits arising from property, professions, trades, and offices. In the year 1842, the revenue of the United Kingdom being insufficient to meet the public expenditure, it was decided to revive a tax which had in past times been levied in emergencies. Accordingly this tax was reimposed—in the first instance for three years only; but at the expiration of that term, and ever since, by renewals, its existence has been prolonged, though its rate in the pound has frequently varied by successive Acts of Parliament. In the case of property, the tenant or occupier is primarily liable to pay the tax, but he is entitled to deduct a proportionate

part from his rent, and he cannot by any agreement with his landlord deprive himself of this right. Income under £160 a year is free of income tax, and any sums paid therefor in respect of property are recoverable for a period of three years from their payment. Also where the income does not exceed £400 per annum, an allowance of £160 per annum is made. There is also in all cases a deduction permitted for life insurance premiums, and from 1910 (ante-dated 1909) a further allowance in respect of children. In 1907 differential treatment was applied to incomes below £2,000, a relief of 8d. in the £ being allowed on earned income.

Incomplete (MONOCHLAMYDEÆ or APETALE), a sub-class of Dicotyledons (q.v.), characterised by the reduction of the perianth to a single whorl, generally sepaloid, or by its entire absence. The plants of this sub-class are also usually dichinous (q.v.). They are probably, in most cases at least, degraded types; but their distribution among their nearest dichlamydeous allies, though it has been attempted, is a matter of the greatest difficulty. They are subdivided into the two series *Hypogynæ*, with a superior ovary, and *Epigynæ*, with an inferior ovary, the former series containing seven, and the latter three, cohorts; but there is very little apparent direct relation between these cohorts. The hypogynous ones are *Piperales*, the peppers (q.v.); *Urticales*, the nettles, figs, mulberries, hemp, hop, elms, and planes; *Amentales*, or catkin-bearers; *Euphorbiaceæ*, the spurge [EUPHORBIACEÆ], *Daphnales*, including daphnes, proteads, bay, and nutmegs; *Chenopodiæ*, including spinachs, amaranths, rhubarbs, docks, etc., and *Nepenthales*, the pitcher-plants. The epigynous ones are *Querñales*, the oaks, beeches, hazels, walnuts, etc., the *Asarales*, including *Aristolochia* (q.v.) and *Asarabacca* (q.v.), and *Santalales*, including sandal-woods and mistletoe.

Increment, UNEARNED, an expression denoting the increase which takes place in the value of landed property without any exertions on the part of its owners.

Incubus. [DEMONOLOGY.]

Indemnity, a written memorandum or undertaking to secure the party to whom it is given from all danger and damage that may ensue from any act or omission of the party giving it. An Act of Indemnity used to be passed by Parliament, annually for relief of those who had neglected to take the necessary oaths of office, etc. [GUARANTEE.]

Indenture. [DEED.]

Independents, a Christian body, identical with the present Congregationalists, which grew up in England during the reign of Elizabeth. They differed from Episcopalians in having no gradation of ministry or succession of orders, and from Presbyterians in having no gradation of courts or assemblies exercising any authoritative or judicial functions. Ecclesiastical government in any form was by them entirely rejected, and each congregation became an independent and separate body of

worshippers, which looked for guidance to the Almighty alone. Regarding the Bible as the sole standard of faith and doctrine, and holding that the individual believer is competent to interpret it for himself, they were indifferent to the voice of antiquity, the decisions of councils, and the tradition of the Church. Their doctrinal views were consequently somewhat vague, but in the main they agreed with those of other Puritans. The religious principles of the Independents were first set forth in a series of tracts, published chiefly between 1571 and 1581, by Robert Browne, a clergyman and graduate of Cambridge. Although Browne himself subsequently conformed, his views were adopted by a large number of persons, especially in the eastern counties, who became known as Brownists. Several congregations were formed in London and elsewhere, but religious dissent was still regarded as a crime against the State. The Independents were driven to worship in secret; when discovered they were thrown into prison, and five of their leaders, including Henry Barrowe, a barrister of Gray's Inn, were put to death. A large number were banished, and the year of Barrowe's execution (1593) was marked also by the settlement of many exiled Brownists in Holland. After the arrival of John Robinson in 1608, who was followed two years later by Henry Jacob, a church was formed at Leyden, which has been called the "parent of Independency alike in England and America," and this is literally true, for in 1616 Jacob returned to England and made use of his experience in organisation to found the first regularly-constituted English Independent church, whilst the band of Pilgrim Fathers which sailed to New England in the *Mayflower* (1620) was composed of members of the Leyden congregation. It is computed that within the next twenty years the original settlers were joined by 25,000 new emigrants from England, and the success of the American colony gave a powerful stimulus to the system at home, notwithstanding the repressive measures of Laud. Up to the period of the Civil War, however, it had gained no great hold over the people at large, and the outbreak of hostilities, in so far as it resulted from religious causes, was due less to the Independents than to the Presbyterians, a party as firmly opposed to the principles of toleration which the Independents advocated as the Episcopalians themselves. But with the ascendency of Cromwell and the victories of the New Model the influence of Independency extended, and it finally took the place of Presbyterianism as the religious basis of the revolution. During the period of the Commonwealth the Independents showed that their attachment to their peculiar system was not so great as to prevent them from adapting themselves to existing ecclesiastical arrangements. Many of them accepted benefices and received titles, though at the same time there was an attempt to create a special Independent Church side by side with the parochial organisation. In 1658 a synod of Independent Churches was held in London, which drew up the Savoy Declaration, following in doctrine the Westminster Confession, but adding their peculiar theory of Church government. The restoration of Charles II. was followed

by a series of Acts depriving Nonconformists of all religious privileges, but these were to some extent regained by the Toleration Act of 1689. Since then the various civil and religious disabilities of Independents and other Dissenters have been gradually removed. The Congregationalists are now united in a "Congregational Union of England and Wales," with subordinate "County Unions."

Index Librorum Prohibitorum, or INDEX EXPURGATORIUS, an official list issued by the Roman Catholic Church, containing the names of all works the reading of which is forbidden on the ground that they tend to promote infidelity, heresy, or immorality. The edict of Constantine the Great, suppressing the writings of Arius, after they had been condemned in the Council of Nicaea (A.D. 325), was the first of a series of imperial and Papal decrees which sought to uphold the authority of the Church in this matter. The first catalogue of prohibited works is said to date from the pontificate of Gelasius (494). The suppression of pernicious literature was generally entrusted to the bishops, but it afterwards became one of the functions of the Inquisition. The decree *De Impressione Librorum*, issued by the Lateran Council in 1515, enacted that before being printed a work must receive ecclesiastical sanction. The first Roman index, in the modern sense of the word, was published by Pope Paul IV. in 1557. Owing to the vast increase in the number of unlicensed works, many of them containing direct attacks on the Papacy, which resulted from the Reformation, it was found necessary at the Council of Trent to entrust the preparation of a complete catalogue to a specially-appointed committee (1562). As its labours were unfinished when the council came to a close, the work was carried on by Pope Pius IV., who in 1564 issued an index which forms the basis of that now in force. It was accompanied by the "Ten Rules," explaining the principles on which it was drawn up and intended to serve as a guide for the revision and extension of the list. This task is now carried out by the "Congregation of the Index," comprising a prefect and other cardinals, together with "consultors" and "examiners of books." Besides books absolutely prohibited, there are others which may be read after the objectionable passages have been expunged. The Congregation has shown itself quite unable to keep pace with the growth of modern literature, and some of the most formidable attacks on the Roman system are omitted in the catalogue.

India. [For general article on this subject, see vol. vi.]

Indiana, one of the United States of North America, situated between Lake Michigan and the Ohio river, which forms its southern boundary. Its eastern and western limits are represented pretty closely by the meridians $84^{\circ} 49'$ and $88^{\circ} 2'$ west longitude. The length is 276 miles, the breadth about 145 miles, and the area 33,809 square miles. The surface generally consists of an undulating table-land, having a mean elevation of 735 feet above sea-level, and sloping slightly to south-west. There are no mountains, and the diversities of

level are mainly produced by the numerous rivers, of which the Ohio, the Wabash, the two branches of the White River, and the Maumee are the chief. Towards the north open prairies are the prevailing feature, but the southern portion of the state was originally covered with dense forests. Coal is very abundant, but not of uniformly good quality, and building-stone, fire-clay, and kaolin are also found in large quantities. As elsewhere, the carboniferous strata contain caves, that of Wyandotte being remarkable for its size. The soil is adapted to the growth of wheat and other cereals, maize, fruits, and vegetables. Immense numbers of cattle, sheep, horses, and swine are bred in the pasture-lands and forests, and honey is an important product. Manufactures and trade have developed enormously during the last fifty years, and, besides the great main lines traversing the state from east to west, a network of nearly 5,000 miles of railway spreads over the entire surface. The educational system is admirable, and more than 70 per cent. of the population under twenty-one find place in the schools. The State University is at Bloomington, and Normal School at Terre Haute, and the Agricultural College at Lafayette. Indianapolis is the capital, and other important towns are Evansville, Fort Wayne, Terre Haute, New Albany, and Lafayette.

Indianapolis, the capital of the above state, is placed almost in the exact centre, and is distant 194 miles south-east from Chicago, and 824 miles west of New York. The site was formally selected, and the city laid out in 1821, in the solitude of the virgin forest. The ground-plan closely follows the lines of Washington and other American capitals, the streets being disposed in rectangular fashion. In 1824 the state capital was transferred hither from Corydon. Pork and corn are the chief sources of prosperity, but many important manufacturing and commercial interests have grown up with the growth of the place. Among the public buildings are the State House, just completed at a cost of two millions of dollars, the public library, the arsenal, and the Marion Court House. Twelve main lines of railway meet at the Union Depot, and the traffic is enormous.

Indian Fire, a mixture used chiefly for purposes of pyrotechny and signal lighting. It burns with a fine white light, and is composed of a finely-powdered and intimate mixture of *nitro*, 24 parts; *sulphur*, 7 parts; and *realgar* (q.v.), 2 parts.

Indian Ink, or CHINESE INK, appears to have been in use among the Chinese since the year 250 B.C., while other kinds of ink date from a still earlier period. It is made from lampblack held together by some medium, usually animal glue. The lampblack is obtained by burning resinous matter, or, in case of better qualities, oil of sesamum. The soot, consisting almost entirely of animal charcoal, is collected and thoroughly mixed up with a still liquid glue, and then placed in wooden moulds to harden and dry. Camphor and various perfumes are occasionally added to scent the ink or improve its colour. It is employed largely by draughtsmen and by artists, giving a better colour and being easier to work with than ordinary ink.

Indian Mutiny. [INDIA.]

Indian Ocean, the name given to the vast body of water that extends upwards from the Southern Ocean between the continents of Africa and Australia, and, reaching the Asiatic coast, is split up by the Indian peninsula into the Arabian Sea west, and the Bay of Bengal east. The 38th parallel of south latitude may be taken as its lower limit, the configuration of the bed showing a sort of natural boundary along this line, and the whole area of 17,000,000 square miles is unevenly divided by the Equator. The Red Sea and the Persian Gulf branch out to the north-west, and a wide channel, dotted with islands to the east, opens into the Pacific. The average depth is 2,500 fathoms, but this is considerably increased between Java and Australia, whilst a diminution of 1,000 fathoms takes place along the southern limit, and is marked by the volcanic islets of St. Paul, New Amsterdam, the Crozets, the Kerguelen, Prince Edward, and Heard groups. Madagascar, Mauritius, Bourbon, the Seychelles, the Comoro and Chagos groups, the Maldives and Laccadives, and Socotra, rise from comparatively shallow banks in the western portion, whilst Ceylon, the Andaman, and Nicobar clusters mark a similar platform at the entrance of the Bay of Bengal. The currents, especially in the northern half, are considerably affected by periodical winds.

Indian Red, a mineral obtained chiefly from the localities of the Persian Gulf. It is employed to an extent as a pigment, and consists chiefly of silicate of iron.

Indian or Western Territory. 1. An area set apart by the Government of the United States as

the dwelling-place of dispossessed tribes of Indians. It extends over some 70,000 square miles, being bounded N. by Kansas, S. and W. by Texas, and E. by Arkansas. Crossing this tract from E. to W., you pass first through a stretch of rich prairie intersected by many streams, next through a belt of forest, and finally reach the Great Plains that slope up to the Rocky Mountains. There are few elevations over 1,000 feet, except in the E. portion. The Arkansas river, with its tributaries, drains the upper and central district, and the Red River forms the S. boundary. The inhabitants, mostly compulsory immigrants, are settled according to tribes on defined reservations, and include representatives of almost all the primitive families, such as the Choctaws, Cherokees, Osages, Modocs, Shawnees, Pawnees, Apaches, etc. The Missouri, Kansas, and Texas Railway crosses the territory, which is dependent to some extent on Arkansas for its government.

2. The name is also given to a tract of British America beyond the Hudson Bay Company's demesne, and vaguely bounded by the latitude 52° 30' and 70° and by the longitude 108° and 141°. This country is thinly populated by native hunters and a few white traders.

Indian Yellow. Two colouring materials are known under this name—(1) an organic dye, known also as *azo-yellow* or *azo-flavin*; (2) a pigment, known also as *purree*, which is extensively employed in India for the manufacture of paints for woodwork, etc., or of water-colours. It is prepared from the urine of cows fed upon mango leaves, and comes into commerce in the form of round balls of a yellow colour.

